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VOL. I. OCTOBER. No.

THE LONDON PHYSIOLOGICAL JOURNAL;

OR,

MONTHLY RECORD OF OBSERVATIONS ON ANIMAL AND VEGETABLE ANATOMY AND PHYSIOLOGY,

Chiefly made by the Aid of the Microscope.

EDITED BY

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BODL. BIBLIOTHECA

Assisted by many Eminent Observers.

LONDON:
PUBLISHED FOR THE PROPRIETORS
BY JOHN VAN VOORST, 3, PATERNOSTER ROW.

1843.

E. W. MARTIN, PRINTER, CURSITOR STREET, CHANCE

Price One Shilling.

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TO ADVERTISERS.

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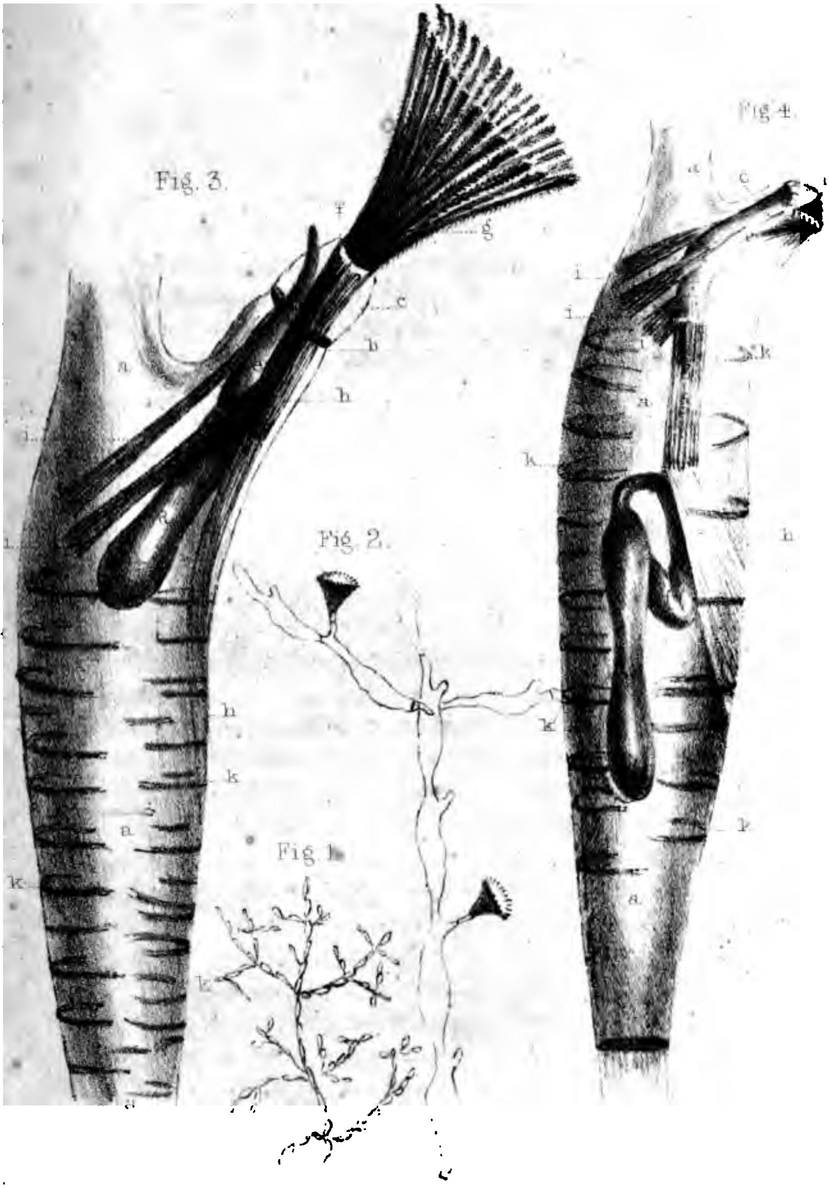
ANATOMY OF PALUDICELLA ARTICULATA



THE LONDON

PHYSIOLOGICAL JOURNAL.

ON THE APPLICATION OF THE MICROSCOPE TO SCIENTIFIC PURPOSES.

At a time like the present, when science is making such rapid strides towards improvement by the united labours of philosophers, and by the more extensive use than formerly of those numerous auxiliaries by which the understanding is the more easily enabled to comprehend the wonderful phenomena of Nature, we cannot fail to observe how much philosophers are indebted to those beautiful contrivances which so effectually minister to the assistance of our senses. There can be no doubt that some of the organs of sense in many of the lower animals, are endowed with functions in a higher degree of perfection than corresponding organs in man, but we generally, indeed invariably, find that this keenness of one sense is given by an all-wise Creator to compensate for an obtuseness, or, in some instances, an entire absence of some other sense. In man, however, a due relation exists between all the senses. We find in man in his natural or healthy condition, no extraordinary developement of one sense at the expense of another, but a beautiful and harmonious adjustment of them. The senses of vision and audition in many animals, in other respects infinitely less gifted, exceed in acuteness those of man; but man from his higher and more comprehensive intelligence, fails not to perceive this comparative inferiority, and therefore endeavours to compensate for the disproportion occasionally existing between his senses and certain bodies, by having recourse to those instruments which his ingenuity and scientific knowledge have enabled him to construct, and by which his senses of hearing and seeing convey to him impressions which would otherwise have been lost.

Very few have ever beheld for the first time the minute and wonderful creatures, which the microscope has brought within the compass of man's vision, and have not felt a thrill of enthusiasm and exclaimed—"how truly wonderful!" Our own recollection of our sensations, and our experience of the effects in others, convince us that this is no magnified statement of the effects upon most under the circumstances; indeed, we should not entertain much sympathy with any one who could behold the wonderful works of the Creator, so palpably and clearly, and—as if suddenly endowed with a new sense—for the first time laid before him, without some such feeling as that alluded to.

It is, however, only within the last quarter of a century that instruments, which so faithfully disclose to us those previously hidden beauties, have been held in that just estimation in scientific researches which their importance demands. It is true that many of the older observers had recourse to instruments for aiding vision, and, in many instances, with a success that has surprised all those who have been aware how imperfect these instruments were; but the microscope, until the present time, has never been made, and may even now be scarcely regarded as a constant aid in scientific investigation.

Even in this enlightened day, one occasionally hears the microscope spoken of as if it were an instrument which *made* that which one sees by it, instead of merely disclosing to us that which always existed, but which had previously escaped our observation; as an auxiliary, in fact, to the existing means of research; and it is not uncommon to hear it said, that no dependance ought to be placed in what is disclosed by its means, because, forsooth, observers give different descriptions of what they see. This last reason for not trusting to microscopic investigation, notwithstanding its palpable absurdity, which might with equal force be applied to all scientific inquiries from the earliest time down to the present day, is yet, we assure our readers, not infrequent.

Among other of the older observers who had recourse to this instrument, Lewenhoeck and Hooke especially deserve honourable mention. Most of the other votaries of the study of objects belonging to the animal and vegetable kingdoms, remained satisfied with ascertaining the characters and properties of bodies by their unassisted senses, and thus left a vast field unexplored for the labours of their successors. The modern inquirer seldom now contents himself with the examination of bodies by his own unaided powers of observation, but has recourse to many contrivances which more effectually enable him to discover the arrangement of the most minute atoms of bodies.

Among other contrivances the microscope, notwithstanding the sarcasms of a few sneerers, is now happily beginning to be justly appreciated. The extensive use of this instrument in the investigation of the phenomena exhibited in both kingdoms of nature, has rendered its application a *sine quâ non* in every scientific inquiry, and has been of the highest service in correcting previous errors, upsetting old theories, and in establishing new views. In fact, this instrument is as essential to the philosopher in aiding him to discover the otherwise hidden operations of nature, as the compass and the sextant to the navigator in enabling him to steer his bark through the trackless ocean to the most distant countries.

Not alone is the microscope confined to the study of the philosopher, but a taste for witnessing the hidden beauties disclosed by its use is rapidly springing up among the public, and forms a part even of the elementary instruction of youth. The microscope, therefore, may at no distant period be as much required to teach natural history, as the globes to teach astronomy and geography, and what are termed philosophical and mathematical instruments natural philosophy.

Microscopes were formerly sought after as toys, or amusing machines, fitted up with some dozen of objects in "sliders," which, when once the possessor could fairly exhibit to his friends, he considered himself perfect in the use of his instrument, applying it very little further than looking at a hair, a flea, or a scale of a fish, or some other chance object.

But, notwithstanding the great capability of these instruments to amuse the comparatively ignorant, by displaying the beauty of form of the smallest atoms, and making evident otherwise invisible bodies, they must be regarded now in the light of essential requisites in the higher and more elaborate scientific investigations; and their employment in such inquiries constitutes their true and legitimate application.

Let us direct our attention to the discoveries made chiefly by microscopic researches in various departments of science, and endeavour succinctly to point to the numerous subjects to which the microscope is required in their investigation.

In palæontology, e.g., Professor Owen, by the examination of a tooth alone, or even a portion of it, has been able to decide disputes which interfered with the arrangement of gigantic fossils. To use his own words, "by the microscope the supposed monarch of the saurian tribes—the so-called *Basilosaurus*—has been deposed, and removed from the head of the reptilian to the bottom of the mammiferous class. The microscope has degraded the *Saurocephalus* from the class of reptiles to that of fishes; it has settled the doubts entertained by some of the highest authorities in palæontology, as to the true affinities of the gigantic *Megatherium*, and, by demonstrating the identity of its dental structure with that of the sloth, has yielded us an unerring indication of the true nature of its food."* By the examination of another fragment of a tooth where very little of any other part of the animal has yet been discovered, he has determined that there have been reptiles of gigantic size, as compared to any of the same class now existing—we allude to the *Labyrinthodon.*

In recent animals, the microscopic examination of the teeth has enabled the same distinguished physiologist to classify the more highly organised classes of animals by the appearances of the minute structure and arrangements of the several portions entering into the formation of the tooth.

In anatomy—when we look to the labours of Lewenhoeck and Hooke, and their successors, down to the present time—we find that every tissue and organ have been most minutely examined. The labours of Miescher, Fleurens, and Tomes, have added much to our knowledge of the minute structure and developement of bone, as have those of Bowman and others of the structure of muscle. Those of Kiernan, Heule, Schwann, Grüby, and numerous others, upon the minute anatomy of organs, may also be alluded to as adding much to our knowledge of these subjects. Indeed, so numerous are the observers of the present day, who have contributed information by making use of the microscope in their researches, that we feel it invidious to individualize any further. The successful injections of the vascular system by many anatomists, as seen by the microcope, have tended much to enlighten us in nature's processes; and those of Mr. John Quekett and others, lead to the belief in the existence of a peculiar arrangement of the capillary blood vessels for each organ and function of the body, and that this arrangement is found in the same organ exercising the same function, in different classes of animals.

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* Address to the Microscopical Society of London, February 15th, 1841, p. 16.

In the Mollusca it has been found by Mr. Bowerbank, that the shells of all these creatures have a true structure, and are not mere deposits, without arrangement of calcareous matters from the animal within; but that they have a cellular fabric, filled with carbonate of lime, which renders their mansions as completely organised as is the internal skeleton of the higher classes. Dr. Carpenter has shown, that there is also a particular structure characterizing particular tribes, and proposes the varieties in form and structure of the cells, as a guide to classifying certain groups, and reconciling certain mis-placements of peculiar mollusks, arranged according to the present mode of classifying them.

In the class Infusoria, Ehrenberg has shown an extent of research unequalled by any other microscopical observer, to which his elaborate work bears ample testimony. He has made us acquainted with the greater part of those atoms of existence which are at present known; he has detected a very complicated structure in many; he has witnessed to a great extent, and well described the mode of their reproduction and their peculiar habits; he has even detected the remains or skeletons of these minute organisms for some miles in length and breadth, and for some feet in depth in the fossil earths, and has even found them in a living state many feet below the city of Berlin.

In the vegetable as in the animal kingdom, the microscope has been the principal, indeed the only instrument by which we have attained the knowledge which we possess of the delicate tissues and organs of which plants are formed; and this knowledge has enabled us to explain many of the more complicated formations which occur in animals, from our observing, by the aid of the microscope, the vegetable structures, which are more easily prepared for examination than those of animals, and which yet bear a close resemblance to them. Without the aid of this instrument, the minute structure of many parts of flowers and seeds could not be determined, and consequently any classification of the vegetable kingdom, without this assistance, would necessarily be very imperfect. And we are, moreover, entirely indebted to it for the discovery of the existence of individuals of the vegetable kingdom, which, like some animalcula, are too minute to be appreciable by our unaided powers of vision. The beautiful phenomenon of the movement of the juice of plants, which the microscope has laid open to the eye of the physiologist, has rendered us another most interesting subject of scientific inquiry. The discovery of channels and tubes in plants for the conveyance of air and liquids, has done much towards our obtaining more correct views of nutrition and growth in plants, and how great is the analogy between certain vital functions in both kingdoms of nature.

Not only has the microscope been found absolutely necessary in various branches of natural history, and in anatomy and physiology, which may be said to form part of natural history, but in many other branches of knowledge it is no less valuable. It adds, for example, to our knowledge of medicine and surgery. The physician is enabled to detect by it a certain diathesis which may be prevailing in the system of his patient, by the examination of deposits from certain excretions, the detection of which may suggest to him the appropriate remedies for the restoration of his patient's health; he is enabled also to detect lesions in organs which would otherwise escape unnoticed, and the observation of which, when considered with the symptoms, may afford him great assistance in his diagnosis at some future period. The surgeon is enabled to watch nature's process of repairing lost or ulcerated parts, by successive additions of organizable matter, and has also been enabled to ascertain that some cutaneous diseases are induced solely by the presence of animal and vegetable parasites; and he has been further enabled to perceive, and to watch the precise appearances and changes which parts affected with inflammation assume and undergo, and the physical character of certain matters secreted during its progress.

In chemistry the philosopher, by the aid of the microscope, and its power of exhibiting the phenomena of what is called polarized light, can often tell the composition of bodies, solid and fluid, by certain appearances, as well as by the complicated, expensive, and tedious analytical processes, which he performs in his laboratory. Not that we would by any means wish it to be understood that we undervalue the utility of these processes in chemical investigation, for we are well aware that it is only by the observation of appearances which these bodies present, the composition of which has been previously made out by chemical analysis, that we can be made aware of the name of the substance which may be the subject of our attention. The microscope is only useful in this branch of science, in preventing the necessity of such frequent repetitions of these processes. The chemist can also detect the shape of minute bodies, and the nature of many coloured appearances in crystallization is capable of being observed and understood, which no other means could have determined. He can also often witness many singular and beautiful effects in the formation of crystals, and in the solution of various salts. In fact, chemical investigations may be carried on under the focus of the microscope with minute quanties, as under the eye with larger masses, and in many instances with equally certain results, as have been partly shown by the delicate experiments of the Rev. J. B. Reade, and clearly shown in the crystallization of the biniodide of mercury, in those of Mr. Warington.

The microscope, again, is available in determining questions of a medico-legal nature. It often happens, that the quantity of a poison criminally administered, is too small, or in a condition otherwise unfavourable to be detected by our unassisted eye-sight. When this is the case, the microscope is of the highest use. It is but a short time since that cases occurred in which this instrument satisfactorily showed the nature of the noxious ingredient, and placed the substance, unchanged in its physical character, as clearly before the eye of the culprit as before his foul hands attempted to conceal it.

It has also been used to detect stains of blood and other animal fluids after a considerable lapse of time, and thus has often afforded most important information in clearing up medico-legal difficulties.

The detection of fraud in articles imported into the country is another application of the magnifying power of the microscope. The revenue is often defrauded by one fecula, upon which the legislature has imposed a higher duty than another, being imported and entered as the cheaper; but the microscope has frequently detected, and satisfactorily decided the attempted imposture, when the ordinary appearances at first sight have borne so close a resemblance as to elude the observation of the government officers.

Many articles of food are frequently the subjects of adulteration, yet the fraud cannot escape detection from the microscope, when the suspected article is submitted to it. In fine, it is quite impossible at the present time, justly to appreciate the extent to which the microscope may and will hereafter be applied in the arts, sciences, and medical police. The number devoted to microscopic inquiries at the present time, and their eminence in the various branches of science, must be sufficient to convince the most sceptical, that the value of these inquiries is every day becoming more important; and their value in upsetting preconceived and unsupported notions, by putting under our eyes the true state of every minute organized or unorganized body, must be sufficiently evident to every one who has paid any attention to the progress of the various sciences during the past few years.

The value, indeed, of these inquiries is continually enforced by the various lecturers on scientific subjects, and the knowledge obtained by them cannot fail to stamp upon every mind, the impress of the great Artificer's illimitable power and goodness. The wisdom which is so clearly laid open to our understanding by this scientific auxiliary, as well in the construction of the minutest atoms as in the largest objects, and by the uniformity of means to ends which is so manifest in the various gradations of animal and vegetable existence, affords convincing evidences of design in the formation of the universe and of the first great cause. Such examples of design as the microscope affords; the wise disposition of atoms to form tissues and organs, and these organs to constitute creatures endowed with vitality, which the microscope so clearly and so beautifully discloses to us, must engender a train of reasoning on His excellence and goodness, and lead us to feel our utter insignificance, and to justly appreciate "His power, might, majesty, and dominion."

It is much to be regretted, that natural history does not occupy a greater share of attention in the higher schools of the country, where those who are to be the expounders of the Creator's word are for the most part educated. We cannot help thinking that this delightful study would more completely satisfy their minds of the majesty of His works. No study more amply rewards its votaries, by giving rise to such delights, yet has no one been more derided; for, even in the time of the celebrated Ray, who had to contend with the prejudice of the age in which he lived, in defence of the study of natural history considered it necessary to say, "no knowledge is so pleasant as this; none doth so feed the soul; in comparison with which words and phrases are to me insipid and *jejune*." The time appears approaching, when the knowledge attained by the modern system of education, and by the learned societies, will render natural history as necessary a portion of education as natural philosophy, or the words and phrases of the ancient Greeks and Romans are at present.

To use the words of Professor Forbes,* "The plea I wish to advance is, that the main use of the natural history sciences to the student, is not merely the teaching him a certain number of facts, the recollection of which may be serviceable to him in after life, but the training his mind, by means of the peculiar forms of research which characterise those sciences, to that tone and vigour which must be of the utmost consequence in giving him power for future professional avocations of a different nature."

By the aid proffered to science of every branch by the microscope, mighty in making small things appear great and elaborate, by the vast amount of knowledge and instruction which it is capable of presenting to us, by this knowledge being of the highest character as respects our acquaintance with nature, and such as to elevate our minds to higher studies, and above those pursuits which are only appreciated by the unlearned, and of teaching man to feel his own inferiority, and his Maker's transcendent greatness; surely an organ established exclusively for assisting to make known to the public in general this knowledge needs no apology for its publication, and justifies the hope that it will meet with that support which its editors have ventured to anticipate.

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* Inaugural address read at King's College, London, May 8th, 1843, pp. 7, 8.

Reviews and Analyses.

On the Muscular System of the Paludicella Articulata, and other Ascidian Zoophytes of Fresh Water. By George James Allman, A.B., M.B., M.R.I.A., &c.

UNDER the above title, Dr. Allman has published a monograph, which is a transcript of a paper read before the Royal Irish Academy.

From the author's account, it appears that this zoophyte has never been recorded until very recently as a native of the British Islands. It belongs to the order *Zoophyta ascidiodida* of Johnston, an order which is synonymous with the *Bryozoa* of Ehrenberg and the *Ciliobrachiata* of Dr. Arthur Farre, and includes all those zoophytes whose organization is referrible to the molluscan type. The subject of the author's paper was found in the Grand Canal near Dublin, and is considered by Dr. Allman to be identical with the *Alcyonella articulata* of Ehrenberg, for which Gervais, who found the animal near Paris, subsequently constituted a new genus, under the name of *Paludicella*, a name which Dr. Allman has adopted. In his remarks upon the muscular system of the fresh water ascidian zoophytes, Dr. Allman's description of this system is chiefly derived from observations upon *Paludicella articulata.* In the description of the muscles, the author has availed himself of Dr. Farre's phraseology, applying to the several sets of muscles in the fresh water ciliobrachiate zoophyte, the same terms as Farre has given to the analogous sets in the cilio-brachiates of the sea.

Three groups of muscles may be detected in the *Paludicella*, which are strictly analogous to muscles which have been demonstrated by Dr. Arthur Farre in the salt water zoophyte of the same order. "The first of these groups corresponds with the anterior set of retractor muscles of Farre, and may be observed (figs. 3 and 4, *h, h*), to take its origin from the internal surface of the walls of the cell near the middle, and thence to pass upwards, in order to be inserted into the margin of the tentacular disc, and upper part of the pharynx." This group, the author believes, is "the true retractor apparatus of the polype;" but neither in this, nor in any other fresh water zoophyte, whose anatomy Dr. Allman has studied, could he detect muscular fibres analogous to those described by Farre, as inserted into the remote extremity of the stomach in those zoophytes of the sea which had come under his observation.

The second set of muscles consists of four bundles of fibres (figs. 3 and 4, *i, i, i*), which arise from the inner walls of the cell near the top, two at each side, having the tubular orifice between them. From this origin, they pass towards the aperture of the cell, slightly converging, and are inserted by distinct attachments, which are all placed in the same plane, into the inner surface of the tube near the margin of the orifice. These, Dr. Allman thinks, are in no respect analogous to the muscles which Dr. Farre describes under the name of opercular, and to which he ascribes the office of assisting in the inversion of the polype tube, drawing in its margin after the retreating polype, and by their continued action, closing the orifice of the cell. This view of the action of the opercular muscles, Dr. Allman is disposed to dissent from, for reasons which will hereafter be stated.

The third group is analogous to one detected by Dr. Farre in the ascidian zoophytes of the sea, and to which he has given the name parietal. They take a transverse course, and originate and terminate in the internal membrane of the cell. In *Paludicella* (figs. 3 and 4, *k, k, k, k*), they are rather numerous, and consist of short fibres of variable length, which pass transversely round the internal tunic, being capable of detection through nearly the entire length of the cell, and sometimes passing one another in their course they may be seen to surround it with a contractile tissue. Dr. Farre is of opinion that these muscles, in the zoophytes which he has examined, are attached by their extremities only. In *Paludicella,* however, Dr. Allman saw nothing which could lead him to suspect this disposition of their muscles; but in this, from his limited range of observation, he does not wish to speak positively.

Although the muscles just described correspond in all their important features with those of the ascidian zoophytes of the sea, and thus beautifully demonstrate the unity of type by which the order is characterized, "yet," says Dr. Allman, "in the details of the several groups, some remarkable modifications will be found to exist."

The first thing which Dr. A. points out, "is the absence, probably among all the fresh water ascidian zoophytes, of that well developed fasciculus of muscular fibres, which is observed in those of the sea to arise from the bottom of the cell, and pass upwards, to be inserted into the fundus of the stomach." Trembley, however, describes, in *Alcyonella stagnorum,* a certain appendage to the stomach, to which he assigns the office of a retractor muscle; but Dr. Allman, from an organ which he has witnessed in this situation in the *Plumatella repens,* is inclined to consider this organ to be an ovary. Dr. A. has satisfied himself that it undergoes no contraction, and that its motions are entirely dependant on those of the body of the polype.

"In assigning their proper office to the muscles which have been already described as the true retractor apparatus of the polype, no difficulty," says Dr. Allman, "is met with; neither can we," he adds, "be at a loss in discovering the true functions of the parietal muscles, for these, acting upon the flexible internal tunic of the polype cell, must necessarily, by their contraction, diminish transversely the space included between this tunic and the body of the polype." But the action of the opercular muscles is not so easy of explanation. In opposition to Dr. Farre, who assigns to these muscles the office of drawing in the flexible portion of the polype tube after the retreating polype, and by their continued action closing the orifice of the cell, Dr. Allman believes that their use is, firstly, "to assist the polype in its protrusion, an office which they accomplish by fixing and preserving on the axis of the polype tube, that portion of the reflected tube-tunic (fig. 4, *c*, *c*), which is included, during the retracted state of the animal, between the summit of the fasciculus of approximated tentacula; and, secondly, which is a still more important function, that of affording to the respiratory surface, when the polype is retracted within the recesses of its cell, a constant supply of fresh water, of which the little animal would be deprived, were it not that some means existed of dilating the tubular reflection of the tunic, an office, to the performance of which these muscles are fully adequate, acting then in a state of antagonism to the parietal muscles, which tend to keep the orifice of the tube closely shut. Dr. Allman proceeds to give his objections to Dr. Farre's view of the functions performed by these muscles; but as we have entered so fully into the author's description of these muscles, and of his own views as to their function, want of space precludes our noticing the arguments which he uses against Dr. Farre's opinions. For these arguments we must direct our reader's attention to the proceedings of the Royal Irish Society. As this polype appears to be almost unknown as a native of these islands, we have inserted the accompanying figures of it in its natural and magnified conditions, and of the muscles so well described in Dr. Allman's little work.

DESCRIPTION OF PLATE I.

Fig. 1. *Paludicella articulata;* natural size.

Fig. 2. Portion of the polypidome magnified.

Fig. 3. A cell with the polype exserted.

a, a, a. The polype cell.

b. The orifice of the cell.

c. That portion of the internal tunic which is carried out by the polype during its egress from the cell.

d. The stomach of the polype.

e. The rectum.

f. The œsophagus.

g. The crown of tentacula exserted and expanded.

h, h. The proper retractor muscles of the polype; they are now relaxed, and carried out by the animal in the act of protrusion.

i, i. Two of the four sets of opercular muscles, also in a state of relaxation.

k, k, k, k. The parietal muscles, preserving, by their contraction, the membrane *c*, in a state of tension, and thus maintaining the exserted condition of the polype.

Fig. 4. A cell with the polype retracted.

a, a, a. The polype cell.

b. The orifice of the cell.

c, c. The inverted membrane, which, in the completely retracted condition of the polype, consists of that portion of the internal membrane which had been carried out in the act of exsertion, together with the more flexible termination of the external tunic of the cell.

d. The stomach of the polype.

e. The rectum.

f. The œsophagus. Both rectum and œsophagus are here curved upon themselves, and thus accommodated to the retracted state of the polype.

g, g. The crown of tentacula retracted, and the tentacula approximated into a close fasciculus.

h, h. The proper retractor muscles of the polype in a state of contraction.

i, i, i. The opercular muscles also contracted.

k, k, k, k. The parietal muscles relaxed.

Abstracts from Journals and Proceedings of Microscopical and other Scientific Societies.

THE THEORY OF NUTRITION, SECRETION, AND INFLAMMATION.

An Abstract from Mr. Addison's Paper read at the Provincial Medical and Surgical Association at Leeds, Aug. 2, 1843.*

By comparing the effect of several re-agents upon the colourless blood corpuscles, with those resulting from their application to pus-corpuscles, &c., I came to the conclusion that lymph globules, pus and exudation cells, and epithelium, originate from these corpuscles, either by a conversion or transformation of them into these objects, or by the growth of the molecules in their interior; a conclusion substantiated by the fact, that the fibrine of the liquor sanguinis was never seen during the progress of its fibrillation to give origin to a globulous particle of any kind.

The chief difficulty in establishing this conclusion arises from the doctrine, that all the blood vessels have permanent tubular parietes. My object on the present occasion, is to show the nature and origin of these parietes, and to point out how the blood corpuscles are included in their interstices. The buffy coat of the blood is composed of elastic fibrous tissue. This may be readily verified by breaking down and washing away all the lower coloured portion of the clot. The process by which it is formed, may be demonstrated in the following manner—(here follow several experiments, which cannot be understood without the plates.)

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* For *The London Physiological Journal*, by the Author.

From these experiments, I conclude that the plastic fluid known under the denomination of liquor sanguinis, is formed and exists within the colourless blood corpuscles, and that when it escapes from them it fibrillates, and if in sufficient quantity forms elastic fibrous tissue.

The fluid, in which pus-corpuscles are found, fibrillates, if any of them have been ruptured; and a loose coagulum is almost always formed in the serous fluid of a blister. Lymph globules hold an intermediate position between colourless blood corpuscles and pus globules, and the fluid in which they are found fibrillates, as does the liquor sanguinis. It would appear from my researches, that the nearer the object is to, or the fewer the stages of its removal from, the circulating current, the more completely it resembles the colourless blood corpuscles; the smaller it is, and the more perfectly does the fluid within it fibrillate when discharged; on the other hand, the further it is, or the greater the number of the stages of its removal from the circulation, the larger it is, the more it is filled with molecules, and the less perfectly does the fluid within fibrillate, until at length, in the normal mucous epithelial cell, it becomes a glairy tenacious liquid, which however exhibits, when examined by the microscope, sufficient traces of a fibrous character to indicate the similarity of its source and nature. This fibrous character in mucus becomes exceedingly distinct, if the smallest quantity of the dilute acetic acid be mingled with it before the examination. These remarks apply to all kinds of mucus, and, if we are prepared to admit—of which I have myself no doubt—that the plasma or liquor sanguinis is by the vital actions of living cells eleborated into mucus, there can be no further difficulty in admitting that similar living cells by a different mode of elaboration in subjection to peculiar laws, may form sundry kinds of tissue, milk, or bile. According to this view of secretion, the colourless blood corpuscles are considered as the organs within which the special tissues and the secretions are formed; and, independently of the demonstrative evidence in favour of this view, it involves the fewer difficulties—for we must allow that all the tissues and all the secretions are in some way or other formed from blood.

These remarks and observations not only corroborate the preceding conclusion, but they lead to the following explanation of the phenomena which give rise to the buffy coat of the blood, in all those cases connected with disease. In pregnancy, and doubtless in other normal conditions of the body, the blood may exhibit a more or less obvious buffy coat; still in these cases the explanation I am about to offer will apply, for any circumstances increasing the amount of colourless corpuscles in the circulation will produce it. But to apply the rationale to disease:—From sundry causes the process of nutrition, or what amounts to the same thing, the function of secretion is disturbed or diminished, and the colourless corpuscles therefore accumulated in the blood. When a vein is opened a greater number than usual flow out, and from the sudden change of temperature to which they are exposed, or from other causes, many of them burst or become ruptured, and discharge their contents, consisting of liquor sanguinis and molecules. After standing a short time this liquor sanguinis rises to the surface, carrying with it not only the molecules with which it was associated in the interior of the corpuscles, but also all the remaining colourless corpuscles which have not been ruptured; it then in a short time fibrillates and forms tissue, as it would have done in the living vessels had the contents of the corpuscles been appropriated for nutrition.

The result, then, of all my investigations, has been to confirm the opinion that the colourless blood cells are very highly organized, and to render it not only very probable, but to my mind certain, that their progress in administering to the maintenance of the living structure is not—as I should say—*back again* into red corpuscles, but *onward* into the higher forms of organised tissue and epithelium. This view of their office and destination makes it exceedingly doubtful, whether the molecules and granules seen in the liquor sanguinis, and in the interior of these corpuscles, be "*young blood cells*," as is supposed by Dr. Martin Barry; and these doubts I strongly expressed in my previous 'researches.'

If we suppose the molecules or minute objects in the interior of the colourless blood cells destined to reproduce cells, it appears to me, it would be to admit of their descending in the scale of organization; whereas, according to the view I take of their nature, there is a gradual rise or progression, without any break or interruption from the primary colourless cells in the intestinal villus, through sundry generations up to the red blood cells, and from these to the more elaborately organized colourless blood cells, which form the foundations of the tissues and the special secreting cells—the link between the blood and the more solid structure, the unity from which the pluralities arise.

Hence it is by the special vital activity of individual cells, and of all the visible particles composing their structures, that *the change from a blood to an epithelial cell— which is the sum of the whole process of secretion—is effected;* just as in the parti-coloured petal we may see a yellow or a pink cell not only contiguous to, but in close contact and structurally connected with a blue, a purple, or a white one. Hence, also, the molecules in the interior of the colourless blood cells are probably analogous to those in the interior of the cells of the petal, and to those so remarkably conspicuous in the interior of the vesicles or cells of the leaf of *Sedum acre* or of any other leaf, which have never been considered as reproductive, and which I believe to be active vital objects, essential to the peculiar contents of the various cells. These opinions are borne out by the countless myriads of molecules in pus, in all epithelial cells, and throughout every portion of the structure of all organized beings, which can hardly be supposed to be reproductive objects; yet the argument is as strong in their favour, as it is for the reproductive faculty of the molecules of the colourless blood cells.*

It is impossible to frame any conception of the process of nutrition in the higher orders of the animal kingdom, that shall harmonize with the results of recent observation, and at the same time leave undisputed the received doctrine that all the blood vessels have *permanent tubular parietes,* without, in fact, supposing that the walls of the capillary blood channels in those places, at least, where this process is actually going on, partake in a more or less rapid alteration.

The appearances presented by the irritated vessels in the web of a frog's foot, the well known adhesion of the colourless blood corpuscles to their walls, and the situation of these corpuscles among the fibres composing them, together with the evident mixture of fibres and altered corpuscles in the walls of the vessels of the transparent membranes of an embryo, and lastly, the structure of the buffy coat of the blood, lead to the following explanation, or THEORY OF THE PROCESS OF NUTRITION.

Nutrition may be normal or abnormal.

In normal nutrition the colourless blood corpuscles first adhere to the tissue forming the boundary of the capillary blood channels; they then pass into and occupy the interstices among the fibres of the tissue, and being evolved upon the nearest free surface (a follicle, crypt, or duct), form epithelial cells; the fluids and other objects given out by the follicles, or flowing from the ducts, being the results of the final dissolution of the cells.

In abnormal nutrition the colourless blood corpuscles adhere to the parietes of the capillaries in much greater abundance; they pass through the tissue-stage, and are then evolved or thrown off from the nearest free surface, a pyogenic surface, as lymph, pus, exudation, or imperfect epithelial cells.

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* Vide the First Series of 'Experimental Researches.'

According to this view of the process of nutrition, the walls of the capillaries are formed by the fibrillation of the liquor sanguinis, previously contained in the interior of the colourless blood corpuscles, some of them being expended in forming the tissue, others passing through it in the interstices of the fibres for further elaboration into epithelium. If the corpuscles congregate in undue numbers, and be hurried through the stages of their growth by any local or specific cause, they come under our observation as lymph, pus, or exudation cells; the various appearances presented by these objects, and the quality of their contents being referrible to the period of their growth, the degree in which they have been influenced by the special laws of the tissue, *and to the chemical action of the fluids they meet with;* for I am able to show, that the *slightest possible* degree of acidity or alkalinity in a fluid, produces very characteristic changes in the colourless blood corpuscles exposed to it.

Hence, then, the buffy coat of the blood has a relation to the lower coloured portion of the clot, analogous to that which the parietes of the capillary vessels have to the blood passing through them; they are both formed in a similar way; and the gradual contraction of the fibres of the clot, whereby it is consolidated, and diminishes in size for hours, indicates very sufficiently how the walls of the capillaries may be consolidated, and form a more compact tissue after death.

I have called the preceding explanation of the process of nutrition a theory, because it involves some hypothetical considerations; and as all medical or physiological theories are justly viewed with great doubt and suspicion, it will be advisable to recapitulate the facts, in order to show how far the demonstration goes, and how much is left for the hypotheses to fill up. *The facts* are these:—

1st. Great multitudes of colourless corpuscles are at all times circulating in the blood; they are particularly abundant in vessels actively engaged in nutrition; they are seen attaching themselves to the inside of the vessels in the web of the frog's foot, and their number is very much increased when the tissue has been irritated; they contain in their interior a number of minute molecules, and a peculiar plastic fluid which fibrillates, or forms fibres.

2ndly. Colourless corpuscles and little masses of free molecules are incorporated among the fibres of all growing membranes; in the fibrous walls of the blood vessels; and in the buffy coat of the blood.

3rdly. There is a gradual transition between the colourless blood corpuscles in the interior of the vessels, and the lymph and pus corpuscles, the exudation and epithelial cells on their exterior.

The hypotheses necessary to complete the theory are—that some of the colourless blood corpuscles adhering to the walls of the capillaries, form these walls by the fibrillation of their contents; that others are included in the interstices of the altering tissue, and grow into epithelium; and, lastly, that if the nutrition be hurried or abnormal, they form pus and exudation cells.

The hypotheses are unavoidable from the nature of the investigation; the actual growth of the objects, and their movements through the tissue cannot be seen. But it may be objected, that as *we can see* the colourless corpuscles in the irritated web of the frog's foot adhering to the tissue, *why do we not see* them passing through the tissue and forming fibres or epithelium? To this I reply, that the process is too slow in this example for us to follow the actual stages of nutrition; the corpuscles are some hours congregating; at the expiration of that period, *many may be seen buried among the fibres of the capillary parietes.* This is as far, perhaps, as we can expect to go in seeing the process of nutrition; and yet, with patience to watch a sufficient length of time, it is in my opinion exceedingly probable, that the link required to establish the theory by actual observation might be accomplished. This *crucial instance* would form an æra in physiological research. But however this may be, it is true that, in the course of two or three days after the application of the irritant, whether salt or warm water, the cuticle or epithelium of the web, composed of pentagonal or hexagonal cells, peels off in large flakes, an event which should occur according to the theory.

THIRTEENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

August 17.—"On the addition of the Order *Nucleobranchiata* to the British Molluscous *Fauna*," by Prof. E. Forbes.—Four years ago the author noticed minute needle-shaped animals floating in the waters of the Frith of Forth and of the British Channel, which when examined under the microscope, presented several anomalous characters which rendered their true position in the animal series doubtful. At the time he was able to make but an imperfect examination of them, which he laid before the Wernerian Society. He has since met with much larger animals, belonging to the same genus, inhabiting the Mediterranean seas, which enable him to refer them to the genus Sagitta of Quoy and Gaimard, placed by those naturalists in the immediate neighbourhood of Firola, in the order *Nucleobranchiata.* Both the British and Mediterranean animals have linear-lanceolate bodies, terminated anteriorly by an oval head, and posteriorly by a horizontal tail. Along the sides are two pair of fins, also placed horizontally, the undermost pair being large in the British, and extremely small in the Mediterranean Sagitta. From the latter the following points of structure were made out: on each side of the head is a row of curved bristle-like processes, which can be erected or depressed at the will of the animal. On the head are two distinct black eyes. The mouth opens into a straight intestine, terminating in a vent where the body begins suddenly to contract, at about two-thirds of its length. On each side of this vent, but opening on the opposite side of the body, is a slightly curved canal, terminating in a *cul de sac,* and resembling closely the canals which contain the pinnated appendages of the *Cydippe,* but empty. The fins are of various shapes, and appear to form a sound basis for specific distinctions. They are rayed. The length of the largest specimen was two inches. The British examples were very minute. M. D'Orbigny has figured and described several species of Sagitta, which he observed during his South American voyages; but the details of his observations do not exactly coincide with those of Professor Forbes. The body which D'Orbigny styles a heart was not seen by the latter in any case; and the only circulation observed was an obscure movement of fluid with granules in the posterior part of the body behind the anus. No appearances of cilia were seen on the external surface. The author concluded, that however anomalous the characters of these curious animals might seem, it was nevertheless convenient, and probably correct, to arrange them among the nucleobranchous mollusca. To the same order he was inclined to refer the shell called, by Dr. Fleming, *Fusus retroversus,* and which appears to be identical with, or at least very nearly allied to, the *Atlanta trochiformis* of M. D'Orbigny.

Mr. Thompson produced a work of Sars, from which it appeared that a similar animal had been found near Bergen, in Norway. The animal in question, therefore, inhabited a large range from south to north.—Dr. Allman had some years ago discovered the *Sagitta* about an inch long, on the south coast of Ireland, and regretted that he had not at the time an opportunity of describing it.—Mr. Thompson had seen Dr. Allman's drawing, and believed the two animals to be of the same kind.—Prof. Forbes said, that with regard to the position of the *Nucleobranchiata* in the animal scale, he believed they were analogues of the *Acalephæ,* only higher up in the scale; they were a step in the progression from polypes through the mollusca up to the vertebrata. In this progression they passed through the cephalopoda, which they resembled in many points. Although an animal might be low down in the direct scale of classification, yet it might possess many of the functions of beings higher up. Thus the cephalopoda frequently present more vertebrate functions than many of the vertebrata themselves.

August 18.—Dr, Allman read a paper "On the Anatomy of *Plumatella repens*," which was illustrated by diagrams, as well as specimens of the animal preserved in spirit. The author divided his paper into two sections; in the first of which he gave the zoological characters of the zoophyte, and in the second entered into the zootomical details of its structure. In the first part of the paper it was attempted to reduce to some sort of order the chaotic mass of synonyms with which the zoophyte in question was encumbered. This was facilitated by keeping in mind the existence of two variations, which *Plumatella repens* is seen to assume. In one of these, the zoophyte will be found attaching itself to flat surfaces, as the under side of stones, and of the floating leaves of water plants, &c., being closely adherent in its entire extent. In the second variation it will be found fixed to surfaces of small extent, as submerged stems and pieces of stick, and, as the animal continues to develop, the branches having no extensive surface of attachment will become free, and a more or less enlarged bushy mass will be the result. *Plumatella repens* exhibits, in a high degree of perfection, the molluscan type of structure; and a distinct pharynx, stomach and intestine may easily be traced. Connected with the mouth, there is here, as well as in other fresh-water zoophytes of the same order, a very singular valve-like organ. The structure of the animal's stomach was described by Dr. Allman with much detail. Two distinct groups of muscles may be detected in *Plumatella repens*, one, which corresponds with the anterior set of retractor muscles, described by Dr. Farre in the Ascidian zoophytes of the sea; and another, analogous to the opercular muscles of this anatomist. The ova will be found to consist, as in those of *Alcyonella*, of a central disk, inclosing the embryonic matter, and of a rim which surrounded the disk, and from which it differs considerably in structure. The disk is formed of two membranes, each of which is composed of a single layer of minute vesicles. These membranes differ from each other in the size of the component vesicles; and as there is but a single layer of vesicles in each, one face of the disk must consequently be thinner than the other. Both faces are concave on one side and convex on the other, and the concave sides being opposed, and the edges united, a closed space is thus formed, which is filled by an immense number of minute whitish globules, floating in a gelatinous fluid, and which are afterwards to be developed into the perfect zoophyte. The walls of the disk are of a horny elastic texture, of a deep brown colour, and when emptied of their contents are found to possess some degree of transparency. There would appear to be no possible way by which the ova can be liberated from the tubes but by the decomposition of the latter; and we accordingly find, after the zoophyte has entirely disappeared from the surface of the stone, on which it crept, rows of these bodies occupying the place of the original polypidom, and mapping out its several ramifications. Notwithstanding the apparently complete destruction of the polypidom, the ova are found closely adherent to the substance to which the zoophyte had been fixed. This would appear to be effected through the medium of that portion of the tube to which they adhered, for the remainder of the polypidom, becoming decomposed and washed away by the action of the water, this alone remains, being protected on each side from the influence of external agents.

Prof. Owen then made several inquiries of Dr. Allman, with regard to the condition of the muscular fibres when in a state of contraction, and whether his observations, on this point, coincided with those of Dr. Arthur Farre.—Dr. Allman stated, in reply, that the muscles were shorter when acting, and sinuous, but he had not observed nodules in the muscles of fresh water zoophytes.—Prof. Owen thought that Dr. Allman was right in placing these animals as allies of the compound *Ascidia,* in which position they must be regarded as analogous to, though having no close affinity with, the polypes. Their tentacula and the vibratile cilia of their respiratory organs were in accordance with their generally elevated structure. They have, in fact, a high degree of organization, but this was generally arrested in a low stage of development.—Mr. Patterson stated, in connection with the subject of the tunicated Ascidians, that he had often found, in the thoracic cavity of the *Ascidia communis,* nnmerous small crustaceous animals; he wished to know if this was a singular fact?—Mr. Peach then described the form of small bodies which he had found floating about in the water, in which he had kept specimens of the species of *Sertularia* and *Campanularia.* From the *Sertularia* there proceeded thousands of small globular bodies, which were covered with cilia, and which were sensitive to the touch; he supposed these must be ova. He did not think they were the tentacula of the animal, as they were floating about by thousands.—Prof. Forbes, in reply to Mr. Patterson, stated, that the existence of crustacea was not infrequent in the thoracic cavity of many of the tunicated mollusca. He had found them in the *Salpa* in great numbers. Some of these crustacea were very large. The phosphorescence of the *Salpa,* which was often observed, did not depend so much on the animal itself, as on the crustacea contained in their inside. He considered the small bodies with cilia, described by Mr. Peach, to be the young of some of the forms of the *Medusæ.* The other was also, probably, a young form of *Medusæ,* and had been described by Sir J. Dalyell, as the young of a Sertularia. —Dr. Lankaster had found *Plumatella repens* at Campsall, in Yorkshire; and as this was an uncommon animal, it might be useful to those who wished to examine its structure, to know its locality. He regretted that the public was not yet acquainted with Sir J. Dalyell's valuable researches.—Prof. Forbes was glad to be able to state, that Sir J. Dalyell had made arrangements for publishing his very valuable collection of drawings, as well as his observations on the habits of the radiate tribes of animals.

August 21.—"On the Microscopic Structure of Shells," by Dr. Carpenter.—The author stated that all the solid calcareous shells of molluscous animals possessed organic structure, in the same manner as the teeth of the higher orders of animals; amongst recent shells this structure is characteristic of various natural groups, and will, therefore, probably afford valuable assistance in the determination of fossil genera and species. The principal varieties of structure were described as consisting of modifications of two simple forms, the Cellular and the Membranous. Of the first of these, the Pinna affords a good example: it consists of prismatic cells, like the cellular tissue of vegetables, filled with carbonate of lime; and if placed in acid, the lime will be removed, and the membrane alone remain, still preserving its cellular structure. In old specimens of the Pinna the animal matter is sometimes destroyed, leaving only the calcareous part of the shell, composed of minute spicula of carbonate of lime, which crumble under the finger. Cellular structure is found in all shells belonging to the order Margaritaceæ. With these the Pinna should be placed, since the Mytilaceæ, with which it has been hitherto classed, possess a different structure. Deshayes, in the new edition of Lamarck, upon a comparison of the characters of the genus Pinna, considers it more nearly allied to Avicula and Mytilus. In the fossil genus Inoceramus, traces of the cellular membrane may be discovered by dissolving the shell in weak acid. The anomalous genus Pandora also exhibits its cellular structure in its thick outer layers, the inner layers being nacreous. Dr. Carpenter proposes to place this genus with the Margaritaceæ. The second class of shells described by the author includes those possessing the membranous structure. In these the calcareous matter is deposited in laminæ, separated by excessively thin membrane, which forms, in fact, a secreting surface. This membrane does not lie flat, but is usually extremely corrugated and folded, and these folds being repeated in a regular manner, give rise to the nacreous lustre of the shells. Fragments of the *Haliotis,* after being laid in acid for a long time are still nacreous. A similar structure is also found in the Cowry and other porcellaneous shells, which are composed of three layers, the direction of the folds being different in each layer, as seen in the fracture of the shell. Another peculiarity in the internal structure of some shells consists of *minute tubes*, ramifying copiously over the different layers of membrane, and sending branches into the adjoining laminæ. Both the membranous and tubular structure are found in the *Avicula cygnipes* of the lias, showing that it belongs to the natural order Pectinidæ, and not to the Margaritaceæ. Mr. Phillips was aware, at the time he published this species, that it was nearly allied to the genus Lima and other Pectinidæ. The structure of the Brachiopoda is peculiarly plicated; and in the true Terebratulæ* all the laminations are perforated by minute holes, going quite through the shell. In a transverse section these perforations are seen to enlarge as they approach the inner surface, forming funnel-shaped openings, lined by a membranous prolongation of the mantle, which is closely adherent to the inner surface of the shell. In one recent species, the *Terebratula psittacea*, the perforations are wanting; but in this species the structure of the hinge is also different, bringing it nearer a particular division of the fossil Brachiopoda (*Atrypa*, Dolman). Most of the fossil Terebratulæ that are *deeply plicated* also want the perforations, and these probably constitute a separate group. In concluding, Dr. Carpenter pointed out some of the peculiarities in the structure of the Echinodermata, which have been noticed by Agassiz in his Monograph. The calcareous plates of an Echinus consist of numerous thin laminæ, connected by little pillars; and as the laminæ are punctured all over, whichever way a section is taken it exhibits a minute net-work. This structure, which prevails in the solid parts of all the Echinodermata, explains the facility with which they absorb fluids. Dr. Carpenter also exhibited diagrams of several beautiful forms of structure in the spines of different species of Cidaris, and in the plates, forming the column of several fossil and recent Pentacrinites, showing that a different arrangement of the internal particles obtained in every species. This structure is well preserved in the fossil species, although they possess a regular crystalline cleavage.

Dr. Allman referred to some points of analogy between the microscopic structure of the shells of the higher molluscs and those of the Ascidiæ. Dr. Lankester compared the structure of the cells in molluscs with those of some plants.

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* The anatomy of the *Terebratula australis* has been minutely displayed by Mr Goadby, of the Royal College of Surgeons, and, we believe, the preparations are now deposited in the unrivalled museum belonging to that institution.—EDITORS.

August 23.—Dr. Allman read a "Synopsis of the Genera and Species of Zoophytes inhabiting the fresh waters of Ireland." —The fresh water Zoophytes of Great Britain have hitherto been all included under the following four genera, Hydra, Cristatella, Alcyonella, and Plumatella. Of these, Hydra is made to include four British species—Cristatella one, Alcyonella one, and Plumatella has been described as containing three species. Of the above nine species, the author was of opinion that two must be erased, viz., the *Hydra verucosa* of Templeton, which appears identical with *H. fusca*, and the *Plumatella gelatinosa* of Flemming, which is evidently the same with Blumenbach's *Tubularia sultana.* To the seven species which remain, Dr. Allman was enabled to add five, of which four do not appear to have been before noticed, and the other is only found described in the Fauna of the continent. The zoophytes at present included under Plumatella were distributed in the synopsis between two genera—those with crescentic disks being retained under Plumatella, while those whose disks are circular were removed to Fredericella, a genus established by M. Gervais for this form of ascidian zoophyte. An important addition now made to the British zoophytes is Paludicella, discovered by W. Thompson, Esq. at Loch Erne, in the autumn of 1837, and since obtained abundantly by Dr. Allman in the Grand Canal near Dublin. In October 1842, a hydroid zoophyte of much interest was discovered by Dr. Allman in the Grand Canal, Dublin; it is referable to no known genus, and occupies a position between Coryne and Hermia. For the reception of this zoophyte, therefore, he has been obliged to form a new genus, to which he has given the name Cordylophora. The synopsis, therefore, embraced several new species and two genera, now for the first time added to the British Fauna.

Prof. Forbes remarked on the value of this paper. In Fredericella we had the analogue of the marine genus Coryne, as we had in Hydra, that of Sertularia. This paper pointed out the impossibility of the existence of such a genus as Hassal's Echinochorium.—*Athenæum.*

THE DISCOVERY OF A MICROSCOPIC PLANT IN THE SERUM OF BLOOD AND OTHER ALBUMINOUS FLUIDS.—BY ANDRAL AND GAVARRET.

The authors, in prosecuting their researches upon the modifications which the blood could undergo in its composition, from a certain number of causes, physiological and pathological, have been much engaged with a communication made to the Academy of Sciences, by Liebig, in which he asserts that fibrine and albumen were perfectly identical substances, and "he had been enabled to precipitate albumen under the form of *globules*, by adding a sufficient quantity of water to the serum rendered neutral by an acid."

When the experiments of Liebig were repeated by Andral and Gavarret, they obtained minute bodies more or less rounded, which they discovered were nothing else than the first rudiments of a plant which bore great resemblance to the *yeast plant*, discovered some time since by Turpin. This plant is not only to be seen in the serum of blood, but also in the "white of the egg," in different serous liquids the result of disease, and in the serous portion of pus; so that when the alkaline portion of liquid albumen is neutralized by an acid, it becomes a suitable matrix for the developement of this minute vegetable.

The process is as follows to witness it in the serum of blood: —Fresh serum is to be diluted with twice its bulk of distilled water, being previously treated by very weak sulphuric acid, until it possesses a slightly acid reaction. The liquid, at first perfectly transparent, becomes immediately opaque; it is slightly turbid by a matter in suspension, which, placed in the focus of the microscope, is absolutely identical with albumen precipitated by heat, nitric acid, or alcohol. By degrees this matter subsides to the bottom of the vessel, and appears as a greyish sediment, whilst the liquid above becomes again perfectly transparent. When produced, this greyish deposit remains at the bottom of the vessel as an inert powder, and does not become the seat of any special change. But it is not the same with the liquid which has become again transparent, as this in a short time presents some phenomena of organization, which can be followed in all the steps of their developement.

About the end of twelve hours, although the liquid has lost nothing of its transparency, it is only required to place a drop of it in the focus of the microscope to determine that there have been produced in it a variable quantity of spherical, elliptical, and oval vesicles, perfectly independent of one another. These vesicles are composed of very thin walls, and are perfectly transparent; some appear completely empty, others are filled with a kind of amorphous matter—lastly, others enclose some globules, few in number, very distinct, and of variable size. It is always in the part of the liquid immediately in contact with the external air, that these vesicles are first formed.

From the surface of these vesicles, in a short time a variable number of buds are produced and develope themselves; they elongate into stalks, which, at different points of their circumference, furnish branches more or less numerous; these give rise to ramifications which increase indefinitely.

The following are the albuminous liquids, healthy and diseased, in which the plant has been found:—

Serum of the blood.
White of the egg.
Fluid within the peritoneum (from scirrhous liver).
Fluid of hydrocele.
Fluid produced by verication.
Fluid obtained by filtering pus.

Comptes Rendus, Vol. XVI, No. 5. *January* 30*th,* 1843.

STRUCTURE AND FUNCTION OF THE INTESTINAL VILLI.

M.M. Grüby and Delafond laid before the Academie des Sciences on the 5th of *June,* a paper upon the Anatomy and Function of the Intestinal Villi, in which they state, that "the villi of the small intestine are covered not only with cylindrical epithelium, but also with another form of epithelium, which, from its situation, they have named *capitate.*" "Each cell of epithelium is provided with a cavity, the orifice of which is sometimes wide open, at others more or less completely closed." "At the surface of the epithelium of the villi of the small intestine of a dog, some vibratile cilia not yet described, of which the function is perhaps to displace, when it is necessary, the coarser chyle, which is in contact with the epithelium."

"Underneath the epithelium, the villus is composed merely of a vascular and fibrous membrane, and within this membrane, of one chyliferous vessels, or canal only."

"In contracting according to their longitudinal axis, the villi become shortened, and take a conical form, of which the base is towards the mucous membrane. In contracting according to transverse their diameter they become thinner and longer. In fine, they execute movements in every way, as we have before said in our note to the Academy on the 4th of *Sept.* 1842. In executing these movements, the villi, empty themselves of the blood and chyle contained in their vessels, and put themselves in contact with the new parts of the coarser chyle digested from the aliments. "Each cell of epithelium must be considered as an organ especially designed to receive the coarser chyle proceeding from digestion, and to convert it into an homogeneous chyle, formed of an infinity of small molecules, held in suspension in a transparent and spontaneously coagulable liquid. These molecules, and the liquid, are the only parts fit to pass through the deep orifice of the epithelium cells, in order to get into the one chyliferous vessel placed in the centre of the villus."

"Each cell of epithelium has a quadruple function :—1st. To fill itself with the coarser chyle proceeding from the digestive process. 2nd. To divide and attenuate this chyle, and convert into a pure and homogeneous chyle. 3rd. To expel this liquid, so elaborated, and direct it towards the chyliferous canal through

the vascular and fibrous tissue. This apparatus we have named Chylogenous. 4th. In fine, to imbibe the substances dissolved by digestion, and to make them enter the vascular apparatus."*
—*L'Experience, 8th June,* 1843.

FILARIÆ IN THE BLOOD OF A LIVING DOG.

M.M. Grüby and Delafond communicated to the Academy of Science the discovery of the entozoa circulating in the blood of a strong and healthy dog. Physiologists have for a long time been aware of the presence of certain entozoa in the blood of reptiles and fishes, but this is the first instance in which they have been detected in the blood of a *living* mammal. It is of high importance to physiology, pathology, and natural history, to show not only the existence of worms in the blood, but also their circulation in this fluid, in the animals which come near to man in the scale of organization. These entozoa have a diameter of 0.003 millimetre, and a length of 0.25 millimetre. These bodies are transparent and colourless. Anterior extremity is obtuse—posterior or caudal extremity is terminated by a very slender filament. At the anterior part may be observed a little round depression, 0.005 millimetre long, which may be considered as the buccal fissure. Their motions are very active. Their life is even prolonged ten days after the blood has been taken from the vessels, and exposed to a temperature of 15° centigrade, or 59° Fahrenheit. They swim among the globules of the blood with great vivacity, exercising an undulating movement. M.M. Grüby and Delafond, found them in the blood taken from the coccygeal arteries; external jugular veins, capilleries of the conjunctivæ, mucous membrane, skin, muscles, and every where this liquid was found to contain them. The urine and other excrementitial matters did not contain them. The diameter of these entozoa being less than that of the blood corpuscles, enabled them to circulate through the capillary blood vessels.—*Comptes Rendus, February 6th,* 1843.

REMARKS RELATIVE TO DISTINCTIVE CHARACTERS WHICH SEPARATE PLANTS FROM ANIMALS, AND TO THE MINERAL SECRETIONS IN THE FORMER.—BY M. PAYEN.

The author, after having studied the classification of the Algæ, by Decaisne, in which some beings formerly considered vegetables had been classed among the polypes, thought it useful to submit some of these *polypiers calciferes* to chemical analysis, so that it might serve to form a distinction between the beings of each kingdom.

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* This last appears to be a general statement of the first three functions, and not a separate function.—Editors.

In comparing *corallina officinalis* and *halymeda officinalis* with *chara hespeda, vulgaris* and *translucens*, Payen observed, that the mineral secretions agreed in their situation, and in proportion dependant on the powers of these living beings; and endeavoured to trace in the tissue of the coralline, when freed from mineral matter, a composition similar to *cellulose*, the principal constituent of vegetable membrane.

After having dissolved from the coralline the mineral matter, by dilute hydrochloric acid, and then got rid of the excess of acid by ammonia, the whole, after being well washed in water, was placed between glasses and submitted to the microscope.

On the addition of tincture of iodine and sulphuric acid, the usual results were afforded which are characteristic of vegetable tissues, and even amylaceous granules were shown to exist by the former re-agent; proving, without doubt, that the corallines above named are not polypes, but algæ, and that they belong therefore to the vegetable instead of the animal kingdom.—*Comptes Rendus, July 3rd,* 1843.

MIRBEL ON THE ANATOMY AND PHYSIOLOGY OF CERTAIN MONOCOTYLEDONOUS VEGETABLES.

In examining the direction taken by the bundles of vessels from the leaf of *agave americana* into the stipe, he was able, in spite of their tortuous course, to trace them from the base of a leaf on the one side down the interior of the stipe to the other, terminating near the circumference, a little above the base of the stipe, and continued into the roots.

In the date the young bud can only develope itself as the new fibres penetrate the "*phyllophore,*" herbaceous stipe, and direct themselves towards the young leaves. But the most part of these filaments have their origin in the stipe, at some distance from the base of the bud, intermingling in their ascending march. The primary roots perish. Auxiliary ones are constantly being formed to supply nourishment.

The disputed point, whether the bundles of fibre and vessels have their origin at the base of the stipe, or are sent into the stipe from the leaves, Mirbel appears to have satisfactory settled, by proving that they originate from the interior of the young part of the stipe. In proportion as the plant gets old, the power of engendering new fibres, is enfeebled and finally becomes extinguished; but their formation is to be found going on in the more recent portions of the stipe.

Gaudichoud denies in great measure many of Mirbel's statements.—*Comptes Rendus, No.* 23. *June* 12*th,* 1843.

MICROSCOPICAL RESEARCHES CONCERNING THE COMPOSITION OF "TARTAR," AND THE MUCOUS DEPOSITS ON THE TONGUE AND TEETH.—BY M. MANDL.

The matter deposited on the teeth, at first in a soft condition, gradually accumulates, and ultimately hardens. If a portion of the softer mucosities on the teeth be diluted with a drop of distilled water, previously warmed, and submitted to a magnifying power of 400 or 500 times, there can be seen a multitude of animalcules, moving very lively, and varying in size from $\frac{1}{500}$th of a millimetre, to a smaller scale. Their form is of a kind similar to those constituting the genus *vibrio.*

If a portion of the tartar be softened in water, and put under the microscope, it will be seen that it is composed of the skeletons of the same creatures, proving that so small a living being is furnished with a calcareous skeleton or shell; and the union of many millions compose the crust on the teeth.

The animalcules in the mouth were seen by Leuwenhock, but doubted by Ehrenberg.—*Comptes Rendus, July* 31*st,* 1843.

THE DISCOVERY OF A MINUTE FUNGUS (MYCODERM), WHICH APPEARS TO CONSTITUTE THE DISEASE KNOWN UNDER THE NAME OF PLICA POLONICA.— BY M. GUNSBURGH, M.D., BRESLAU.

The observations were made on two specimens of the disease in females. The adhesive mass was composed of epidermic cells, some of which contained a nucleus, others granules only, and among the hair small jointed fungi, which are first contained in the sheath of the hairs, and are regularly articulated or brouched. They originate in the bulbs of the true hair in which they are enclosed, and ultimately pierce the exterior.

The minute cells composing the joints of the mycoderm, are at first distinct from each other; afterwards they become gradually less so, and ultimately the filaments of neighbouring plants run together, forming a confused and adhesive mass, with the hair and cells thrown off from the epidermis.—*Comptes Rendus, August* 7*th,* 1843.

Microscopical Intelligence, &c.

VARLEY ON THE METHOD OF PREPARING AND RENDERING TRANSPARENT OBJECTS INTENDED TO BE PRESERVED IN CANADA BALSAM.

It is known that objects are mounted for the microscope in a very durable manner by being inclosed in *Canada balsam.*

A ready means of rendering the objects transparent before they are mounted may therefore be acceptable.

In the ordinary mode, very small objects, such as hairs of animals, tongues of flies, &c., are at once put into a drop of Canada balsam on a slip of glass, and heated till the balsam has penetrated them, when they are covered with thin glass. This frequently leaves air bubbles in the tubular cavities, and some parts will remain opaque, from the moisture not being quite expelled; and with minute fossils, the heat that is required to melt the Canada balsam will expand the air in their cavities, and often burst the objects. All these difficulties are avoided by using the principle of *Endosmose* and *Exosmose,* by which a double permeation of the fluids is effected.

I effect this purpose by using wide mouthed phials filled with oil of turpentine. In these I immerse the selected objects, well cork the phials, and leave them till the objects have become quite transparent. This may be in two or three days, or as many weeks, according to the size of the object; but however large the object may be, it will ultimately become quite transparent; the turpentine will slowly absorb all the air and all the moisture within it, and as gradually take their place. When this has been effected, the object may be taken out with tweezers, and whilst wet immediately laid on a drop of Canada balsam, and the thin glass, with its under side previously coated with balsam, to avoid air bubbles, carefully laid on and gently pressed close. The object may then be examined by the microscope, or at once put by till sufficiently dry for general use. Thus time at the beginning and the end does the principal work for us. There is one great convenience in this mode—if you find an interesting object, and are not disposed to mount it immediately, it can easily be put by in the turpentine, where it will be undergoing preparation, till you have an opportunity to mount it.

The balsam acts in two ways in rendering objects transparent:—first, its density, approaching that of the object, lessens refraction; secondly, its dissolving the fluids, and taking their places, renders the objects more homogeneous, and thereby suffers the light to pass equally well through all parts of them.

HINTS FOR PREPARING OBJECTS FOR MICROSCOPIC INVESTIGATION.

There are at the present time so many ways of *putting up* objects for microscopic examination, and each way being the best suited for its peculiar *preparation,* that we are induced, for the benefit of those of our readers who are just entering upon microscopical inquiries, to lay before them a few hints touching the construction of cells, &c. for inclosing objects for examination, the various kinds of cement now in use for joining the several parts of which these cells are composed, and the different fluids which are used for preserving the preparations inclosed in them.

The first object which the minute investigator desires for the purpose of putting up or mounting his object for future examination, is to form a cell or glass-box, in which to keep it in such a condition as to be enabled to examine it by those powers of the microscope which the preparation requires. This condition must have reference, 1stly, To the minuteness and transparency of the object; 2ndly, To the focal distance of the object-glass with which it is to be examined; 3rdly, To whether the object is to be preserved in a dry state, or in fluid. To adapt the cells or boxes to these conditions, regard must be had to their size, the thickness of the glass with which they are constructed, and the kind of cement which is best suited for each of the conditions above alluded to. We shall commence with those simple forms of cells made by cementing a slip of thin glass* to a larger one of crown or plate glass, the object being inclosed between them, either in fluid or in a dried state. All that is required, therefore, in constructing these cells, is to put the object or preparation; suppose, for example, muscular fibre of animals, or spiral fibre, or any other minute structure of plants, upon a plate of glass of a size to fit the preparation case, upon this put a little preserving fluid, such as Mr. Goadby's fluid,† or a solution of salt and water, and in this fluid place the object; cover the whole with a slip of thin glass, sufficiently large to enclose the object, and allow a little fluid to intervene between the object and the edges of the slip of thin glass. A layer of cement should then be placed at the point where the edges of the slip of *thin* glass come in contact with the slip of crown or plate glass. The cements generally used for this purpose are of two kinds; the one which, to our experience, is the best, is that made by mixing lamp-black with gold size, in such proportions as to render the consistence such as to allow of its being laid on the cell with a small camel or sable's hair pencil, without much difficulty, and not so thin or fluid as to run after being so laid on. The other cement is made simply by dissolving sealing wax in spirits of wine, the rules with respect to consistence being the same for both. The former is much the more advantageous one for many reasons: in the first place, it dries much quicker than the sealing wax cement, especially if it be mixed with a small quantity of litharge previously to its being used; in the second place, it permits the contained preparation to be preserved in spirits, which the other cement does not; in the third place, a thinner layer of the cement is necessary, and the cell has, when finished, therefore, a much neater and lighter appearance; and lastly, it is less brittle, and possesses greater tenacity and elasticity than the sealing wax cement.

(*To be continued.*)

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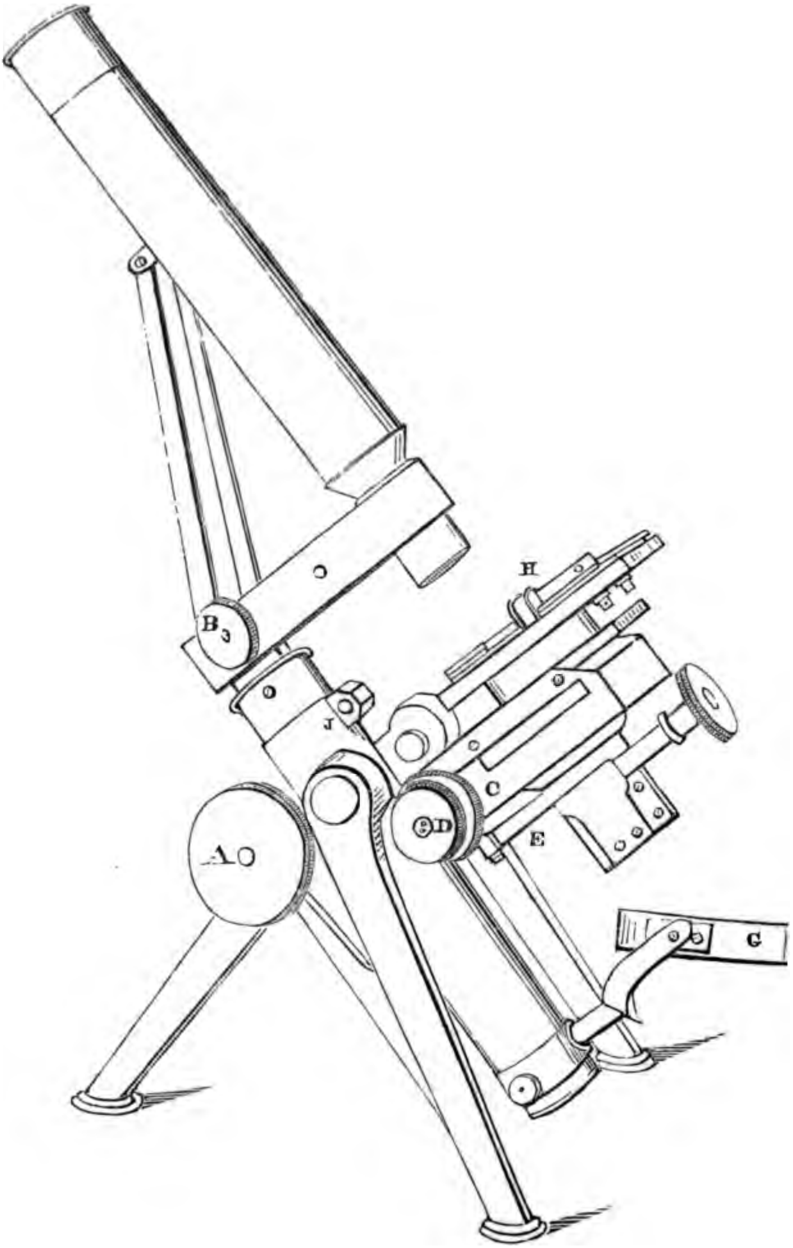
* This glass is manufactured by Mr. Dark of Birmingham, and may be obtained of the celebrated opticians, Messrs. Powell and Lealand.

† We shall give the composition of this fluid in a future number, when we come to speak of the various fluids used for preserving animal and vegetable tissues.



POWELL AND LEALAND'S NEW MICROSCOPE.

OBSERVATIONS CONNECTED WITH THE ANATOMY AND PHYSIOLOGY OF VALLISNERIA SPIRALIS.

By Edwin J. Quekett.

A PLANT so well known as the one about to be described, has associations connected with it, that render it one of interesting character to the naturalist, as well as to others who partake of the delight in contemplating design manifested in any of the works of Creation.

To the vegetable anatomist this plant has equal claims of regard, as to the lover merely of design; for, when the separate organs are examined minutely, perhaps no other will repay the observer for his trouble with a greater share of satisfaction than this.

The opposite character of structure exhibited in the flower stems of the two sexes of this plant, and especially of the female, has given origin to an interesting description of the plant by Paley, who points it out as a beautiful adaptation of a simple contrivance to answer an important end, which will be familiar to all readers of his "Natural Theology."

The genus *Vallisneria* is placed by botanists in the order HYDROCHARACEÆ, Lindley, in the class of ENDOGENS—a group of aquatic plants possessing generally the stamens and pistils in separate flowers, an inferior fruit, and a distinct calyx and corolla, each composed of three pieces; characters which completely separate the order from any other in the same class.

The species of the genus *Vallisneria* are to be found in Europe, America, East Indies, New Holland, and Van Dieman's Land, being natives of warmer climates than our own, occupying the still portions of rivers and lakes, and remarkable chiefly for the contrivances adopted in securing the perpetuation of the race.

The *Vallisneria spiralis* is a native of the south of Europe and also of Van Dieman's Land, and is the best known species in this country,* on account of its being cultivated by many microscopic observers, for exhibiting in the leaves the beautiful phenomenon of the movement of the contents of the cells, a fact first observed, I believe, with reference to this plant, by Mr. Brown.

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* The observations that follow have all been made on the female plant, the male plant being not yet in general cultivation in Great Britain.

The appearance of the plant is far from giving an idea of the amount of interest its structure and habits afford. When not in flower it presents the appearance of a grass growing in water, consisting of ten or twelve linear green leaves, exhibiting a glistening appearance from containing air, having an origin, like as in many *Endogenous* plants, from an axis which is concealed by their sheathing bases. The leaves vary from a few inches to a foot or more in length, depending on the depth of water in which they grow, being about a quarter of an inch in width in vigorous specimens.

The plants are fixed securely in the mud of the spot where they flourish, by an abundance of white hair-like roots, which are generated in great numbers. Nor is the tendency to form roots alone confined to the base of the plant; for occasionally two or three fibres are produced at the base of the ovary, before it separates from the flower stalk—a provision, perhaps, when it no longer swims, to fix the seed vessel to the mud, in order that the seeds may not be carried to a distant spot; or, as this has only been observed on sterile seed vessels, it may be an attempt of nature to propagate the plant in this manner, since the seeds have not been matured.*

The plants are seldom solitary, more frequently forming dense masses; for, in addition to the ordinary method of propagation by seeds, numerous creeping stems are given off, as in the strawberry, which quickly multiply the plant in the same spot.

By far the most interesting portion of this plant is the flower stem of the female, which takes its origin from the axil of the leaf that immediately precedes it in the order of development, bearing a solitary flower, carefully protected by a sheath (*spathe*). This organ rapidly elongates, until it attains such a length that the flower reaches the surface. After this it still elongates, assuming an undulating form, until at last, the excess of length, causes it to float on the surface of the water in a looped form. At this period the flower expands, and lies nearly horizontally on the surface, the stigmas being barely kept above the water.

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* The author has planted some of the separated seed vessels that have roots, in the mould at the bottom of the water in a glass vessel: the only change hitherto witnessed is, that the ovary has considerably lengthened, but no appearance of any leaf or bud from any portion.

By this arrangement two things are secured to the plant—the flower, which is to float on the surface, has provided for it a protection from the submersion of its stigma from the alterations occurring in the depth of the water, which would otherwise be fatal to impregnation, and the coiled loops have the power of retaining within a given space the flowers of the male plant, which are generated on an axis which is inclosed by a sheath (*spadix*), and are destitute of the elongated flower stem; but when advanced to the state when the flower is fit to expand, they severally become detached from the plant, rise to the surface, and become entangled by the floating leaves and flower stems of the female; they then open, and the pollen, by the ordinary external agents, becomes conveyed to the stigma, which is elevated so far from the surface as to be not entirely immersed. Thus is secured the perpetuation of the race, and which could not be more wisely effected than by the simple yet beautiful contrivance manifested in these plants.

Anatomy of the Organs of Nutrition.—When the plant is examined with a view to study the minute structure of the several organs, it will be seen that it forms an exception to the plants of the class to which it belongs (possessing the same degree of developement), by not exhibiting any trace of vascular tissue in any of its organs.

The *Leaf*, when viewed with a magnifying power of 200 linear, is seen to present on either surface a layer of cells, which are nearly square in comparison with those which are more internal, and which are three to five times the length of their breadth. On making a transverse section of the leaf, it will be observed, that the smaller cells are arranged in one layer, forming an apparent cuticle of compressed cells, and the larger, which are arranged in two or three layers occupying the central portion of the leaf, are more nearly quadrangular in section, and represent the parenchyma; no stomata of course are present, the leaves being generally submerged. Without submitting the leaf to the microscope, three transparent lines (veins) can be seen running its whole length, the two lateral uniting with each other, and the central one at the apex. When a longitudinal section is made, so as to exhibit the structure of the vein, it is seen to be composed of exceedingly elongated cells, akin to the ligneous tissue in form, but destitute of the rigidity, and unaccompanied by any trace of vessel; these in the transverse section exhibit a group of very minute apertures, compared with the larger central cells of the leaf.

With a high magnifying power, one cannot fail to remark, that all the cells contain a quantity of green granules, whose number, in a great measure, constitute the colour of the leaf; these granules appear analogous to those met with in other leaves, and to which the term *chlorophylle* has been given. If, however, a young leaf of an inch or two in length be examined, besides these smaller green granules, a quantity, more or less varying, will be observed, which are each three times as large as the former, having also a different structure and composition; which is clearly ascertained by iodine, the smaller grains turning brown under its presence, whilst the larger turn blue, which is characteristic of their amylaceous nature.

In addition to these granules, there is a single one of pellucid character, and larger than any of the before mentioned, which is the cell germ or *nucleus* of Brown, or *cytoblast* of Schleiden. This was first noticed by Mr. Busk, and is distinctly to be seen in the younger leaves especially, and also in the cells of every other organ, and, like the other granules, is not attached to the cell, but revolves freely in the mucilaginous juice within them.

In examining any leaf, by even a moderately magnifying power, it will be observed, that there are very dark longitudinal lines, connected by transverse ones, which mark out the boundaries of the larger internal cells; the darkness of these lines arises from air, which is contained in the intercellular spaces; but it is somewhat curious, that these lines are not regular over the leaf; there being three or four rows, then an interval of the diameter of a cell, then three or more other rows.

That these black lines arise from air in the intercellular spaces is easily shown by taking a small portion of the leaf, placing it in a *compressorium* with a little water, and then viewing the divided edge: if pressure be now made, the air will be seen to escape from the channels, and water will occupy its place. When the pressure is removed, the leaf will then appear very transparent in those portions from which the air has been expressed.

These intercellular passages form a striking analogy with certain tubes or vessels that Mr. Bowerbank has shown to exist around every cell, in many of the shells of the *Mollusca*, the *arrangement* being the same, though probably the *function* may be different, in the *plant* decidedly being filled with air, for the purposes of respiration and buoyancy; whereas, in the *animal*, it is most likely that these tubes convey fluids for nutrition, being seated apart from the organs destined to perform the necessary vital functions.

Stem.—This organ can scarcely be said to exist, except it be in the shape of a *rhizome;* for what may be regarded as a stem, is nothing more than the sheathing bases of the leaves, the true stem, the spot from which the leaves have their origin, being very minute.

Root.—The root of this plant is composed of numerous *fibres*, the size of hog's bristles, of a white colour, which are not entirely buried in the earth, their extremities being frequently the only parts concealed; no branches occur on them, yet in the neighbourhood of the spongiole are some hair-like processes, which, however, are not clearly separated from a parasitic Conferva.

(*To be continued.*)

ON THE OVA OF THE CRISTATELLA, WITH DIAGRAMS; TO WHICH ARE ADDED SOME OBSERVATIONS ON A NEW ZOOPHYTE FOUND ATTACHED TO STEMS OF THE NITELLA TRANSLUCENS.

By Cornelius Varley, Esq.

Dear Sir,—Many of the figures in the diagrams of animalcules used by lecturers on the subject being erroneous, argue that the peculiar habits of these creatures are not yet sufficiently observed. If private observers would contribute the result of their insulated observations to such a Journal as The London Physiological, it would soon yield a very interesting mass of information, for the scrutiny of those most qualified to estimate its value, and properly to *arrange* it.

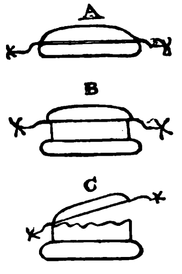

Fig. 1.

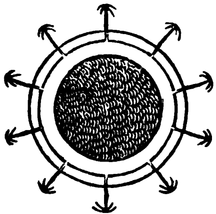

Fig. 2.

The shell or case out of which comes that very beautiful animalcule, the *Cristatella*, has been shown, cracked across like a broken bun to let the animal out. I have had great numbers of these eggs, and never saw one broken, except by violence. The two discs which form the shell are at first close (fig. 1, A), the smaller one being surrounded with grapnels. Each side has a central disc, composed of vesicles, which gives it the appearance of a fly's eye (fig. 2). When they are near opening, the discs gradually increase their distance, a thin whitish membrane being interposed (fig. 1, B), and then open like the round lid of a box (fig. 1, C), when the animal comes out. The two discs are of a dark brown colour, their central discs still darker; but the animal comes out as clear as glass, having two or three plumes. Each plume is forked, or of a long horse-shoe shape, and has a double row of cilia. I have observed a spot in them which at first was pale, but afterwards became darker and darker, and which proved to be an egg, but when separated from the parent it was much smaller than that out of which the parent had come; so that I am inclined to think the eggs of these creatures enlarge gradually of themselves, as they proceed to maturity. How these animals can exist in their eggs, under circumstances to which at times they are exposed, appears a mystery—for the eggs are so light as always to float at the surface of the water, and are frequently blown off into the hollows around the ponds, and consequently are often rendered dry. The little grapnels which surround these eggs to a certain extent prevent this from occurring, by entangling many of them among the weeds, &c., about the surface. They are about the fifteenth or twentieth of an inch in diameter, and occasionally abound in the reservoir ponds at Kentish Town. On one occasion I was enabled to take handfuls of them from the holes made by cows' feet around those ponds, on the side to which the wind was blowing.

Until it was pointed out to him, after his communication had been received, Mr. Varley was unaware that any description of the egg of this animal had been given. We give it insertion, because Mr. Varley's description of it so closely corresponds with that given of the ovum of the same animal by Sir J. G. Dalyell and M. Turpin, as to settle the question as to the identity of the continental and British zoophyte, viz. that found by M. Turpin in France, and that by Sir J. G. Dalyell in the fresh waters of Scotland. We transcribe the following passages, containing a description of the ovum of this Polype by these gentlemen, from Dr. Johnston's work on the British Zoophytes, and it will be seen how closely in many points the three descriptions agree.

"Twenty, thirty, or more lenticular substances, of considerable size and in the most irregular arrangement, imbedded in the flesh, are exposed through the translucent green of the animal. Its death and decomposition towards the end of autumn liberate them to float in the water. Subjected to the microscope, or, indeed to the naked eye, their convex surfaces prove brown, the circumference yellow, and begirt with a row of spines terminating in double hooks. Each is an ovum of the Cristatella with a hard shell, and occupied by yellowish fluid contents."——"In five or six months the ovum gapes at one side to allow the protrusion of an originating polypus, which by a remarkable provision of nature now floats reversed, with the head downwards, to ensure absorption of the liquid element below. On quitting the ovum it attaches itself to some solid substance by the base, then disproportionately large, from which a second polypus quickly rises, then a third, and a fourth; and thus with others. In earlier stages the Cristatella mirabilis seems to be of a circular figure, and in its most mature state there is a margin projecting beyond the root of the polypi."—*Dalyell.*

"The egg, according to M. Turpin, forms a small flattened sphere, with a papillous surface slightly incrusted with calcareous matter. The centre is of a dark reddish-brown or vinous colour, the margin more transparent and yellowish, proving that the egg is vesicular,—the exterior circle marking out the thickness of the cocoon or shell, and the more opaque disk the part occupied with the embryotic fluid. About 16 rough spines radiate stiffly from the circumference: they are tubular, yellow, terminated with from two to four crotchets, and apparently vary in length, for they arise alternately from the edge and from the surface a little behind this.* The egg is filled with an albuminous granular fluid analogous to the vitellus or yolk, for in it the fœtus is perfected after a period which probably depends, in a great measure, on temperature of the season in which they are laid. The time of birth having arrived, the shell opens in two gaping halves, as an oyster opens its valves, to permit the escape of the young polypus, which enters on its existence complete in all respects, either a single individual, or with one or two others, less mature, pullulating from the sides.

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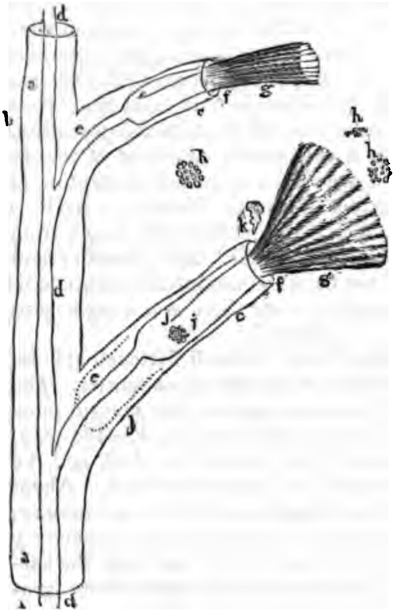
* According to M. P. Gervais this is not the case,—the spines originate solely from the line of junction between the marginal band and the disk:—"du point de contact de cet anneau et du corps disciforme partaient sur l'une des faces les crochets dont j'ai parlé. Je reconnus depuis que l'autre face présentait aussi les appendices en crochets, mais qu'ils y étaient moins allongés."

"One of the most interesting facts ascertained by M. Turpin is, that the eggs before exclusion, and immediately after, are oval or lenticular, and *entirely free of the spines* which roughen them at a later stage. Hence an easy solution of a question touching the manner of escape from the mother, which, before this discovery, seemed incapable of being effected without a painful laceration from their bristling armature. This alteration in the structure of the egg is very remarkable, although not singular, for the eggs of several mites are known to undergo somewhat similar changes. The eggs float in the water from their lesser specific gravity, but often they become attached by their spines to the filaments of confervæ, &c., where they float until the young are hatched and afford to them an immediate place of rest."



The close resemblance of the *Paludicella articulata* of Dr. Allman, some parts of the anatomy of which, by that gentleman, appeared in your last number, to some zoophyte that I have found attached to the stems of the *Nitella translucens*, induces me to give you a figure of it, should it be deemed of sufficient importance. The main tube (*a a*), very thin and of a dark colour, adhered along the side (*b b*), to the Nitella. (*c c*) Are branch tubes; (*d d*) a muscular cord in the main tube, from which branch cords (*e e*) proceeded to the branch tubes (*c c*), having the animals (*f f*), at their ends. The animals glide out *slowly* by some means, and during this act the cord (*e*) becomes elongated.* They draw themselves suddenly in, by apparently contracting that cord. They protrude, as in the upper figure, with their rays (*g*) closed like a brush, and then suddenly expand them, as shown in the lower figure. There were about twenty-three long rays, and as many intermediate short ones, or else additions to the long ones, that appeared as such. These were all lined on each side with cilia, which occasioned a current in a direction towards the interior of the animal. Many small *Gonia pectoralia* (*h h*) were swimming about, some of which were drawn within the vortex, and down the interior. If too large to be swallowed, they were expelled between the tentacula; but I saw several small ones successively swallowed, and they were visible as far down as to (*i*); beyond which they disappeared. The confused opaque mass that filled the returning portion of the body (*j*), was probably the digesting food, for dirt was occasionally thrown out at *k*. They were ordinarily content to retreat into the tube as far as to the dotted line *l*, ready again to protrude. Some of these increased upwards, from twelve to about twenty-five branches. The new outer ends of the branching tubes were quite white, but soon became dark coloured, though the animals themselves always continued transparent. The Nitella to which these were adhering, was obtained either at Totteridge or Hendon.

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* Mr. Varley is of opinion that this cord, when elongated, is in a state of rest, and that during its elongation it is returning to that condition. Mr. Varley has never been able to observe distinct fibres in this cord, but is led to consider it muscular from its action.—S. J. G.

I am, Sir, very truly yours,
CORNELIUS VARLEY.

Reviews and Analyses.

Popular Cyclopædia of Natural Science.—Animal Physiology. Parts 1 *and* 2. By Wm. B. Carpenter, M.D., &c. Orr & Co., Paternoster Row, pp. 579.

WE hail the advent of all works on Natural Science with considerable pleasure, inasmuch as every work published on such a subject must necessarily have the effect of extending that knowledge, which is not only extremely useful in rendering man better capable of availing himself of all the numerous and beautiful instincts which the creatures of which it treats possess, and the properties of the different juices and parts of vegetables which it considers, and thereby opening fresh channels for industry and amusement; but is more humanizing and exalting, in our estimation, than any other kind of knowledge; theology, which should always be left to the guidance of its authorized teachers, being, of course, excepted.

If we hail with so much gratification the publication of works of natural science in general, that gratification is considerably enhanced, when we see brought before the public, in a popular form, a work having for its object to extend to the public at large a knowledge of the principles of Animal Physiology, and more especially of the functions of the different organs belonging to him who is the most perfect of God's creatures. We have elsewhere* expressed our regret, that the natural sciences have not as yet been made a part of the education now in use in the higher schools and universities of this country, and we therefore fully agree with the author of the work before us, when he states that "the want of a good Elementary Treatise on Animal Physiology has heen greatly felt by those who have desired to gain an acquaintance with the science, or who are entering upon the professional study of it. Indeed, the author is inclined to believe, that one cause of the almost complete exclusion of the subject from the educational system of this country† may be traced to that deficiency."

It is well known by every one who has devoted himself to the study of Natural History, that every principle of mechanics has beautiful examples in the various members of the animal and vegetable kingdoms, and that many of the appliances now in use in the arts and manufactures, which were considered the highest efforts of human ingenuity when first discovered, have always been in existence in some almost neglected animal or vegetable. When it is considered also, to what an incalculable extent commerce has been and still is indebted to the numerous objects of both those kingdoms of nature, one cannot but feel surprise that this part of science should have met with so much neglect, and so little encouragement. Numerous instances of the great importance and value to commerce are furnished by the animal and vegetable kingdoms. Let us look for example to the silkworm, and reflect upon the immense amount of labour and capital employed in the preparation and weaving of the valuable contents of its cocoon—the hundreds of thousands of men, women, and children, obtaining their subsistence by these means, and the numerous ways in which money is circulated by it. This is only one source of wealth which the animal kingdom furnishes us with, but numerous others could be easily cited did our space allow it. The vegetable kingdom is equally, if not of more value to mankind; indeed, one would think that the production of the "staff of life" alone from this kingdom of nature, would be sufficient to entitle it to the consideration of every one, possessing even a moderate share of education or intelligence. We beg to apologise to our readers for making these few remarks, which we feel were wholly inapplicable to them, but which feeling so strongly upon this subject, we could not help expressing.

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* "On the application of the microscope to scientific purposes."—*The London Physiological Journal* for October.

† The University of London have introduced it into the course of study required for the degree of A.B.

We will now proceed to the consideration of the work before us, and in so doing, we must express regret that the character of this Journal will not permit us to enter upon many of the subjects of which it treats, and, that our limited space will preclude our doing full justice to those parts which come within its scope.

The author commences by giving a brief recapitulation of what he has stated more in detail in his Vegetable Physiology,* touching the distinctive characters of organic and inorganic substances, and also those of animals and vegetables; and it may be interesting to some of our readers if we transcribe the following remarks upon the digestive cavity or stomach, the possession of which, forms one of the distinguishing characters of animals.

> "Now, this digestive cavity or stomach, with the organs by which the food is introduced into it, constitute the whole structure of the simplest animals. There seems reason to believe, that many of the lower class of animalcules are little else than single *cells*, differing from those of the red-snow or yeast plant chiefly in this,—that there is an aperture or mouth by which nourishment is introduced into their cavity,

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* A notice of this work will appear, in an early number of this Journal.

so that, they do not absorb by their external surface only, but also by their internal,—and that, they are furnished with *cilia*, or little hair-like filaments, by the vibration of which, they are moved actively from place to place, and their food conveyed into their mouths; and it is quite certain, that animals much more highly organised, are composed of little else than an assemblage of such cells, so arranged, as to form a membranous bag, with a mouth, and a circle of arms or tentacula around it, serving to lay hold of and draw in its food.

"This is the case, for example, with the *Hydra*, or fresh water polype, a little animal which is very abundant in many of our ponds, (and frequently found in little pools, in the gutters of the roofs of houses,) and the study of which, has been a most fertile source of interest to the microscopic observer. It commonly attaches itself to a stick, straw, or other floating substance, by means of a kind of sucker at its lower extremity, and stretches out its arms in search of its food, which consists of minute aquatic worms and insects. These are securely laid hold of by one or more of the arms, and are drawn into the mouth, which leads to the stomach, or general cavity of the body, in which they are digested, and from the walls of which, the nutritious portions are absorbed. A kind of circulation, or flow of nutritious fluid through channels, appears to take place even in this simple animal, for the conveyance of nourishment to the arms. The portions of the food which are not capable of being digested, are cast out through the mouth; but in the higher polypes, as in all the more complex animals a second aperture is provided for this purpose. Now, that the lining membrane of the stomach is nothing else than an inward prolongation of that which covers its surface, is evident, from a very curious experiment which has been many times performed upon this little animal, with the same result. It may actually be *turned inside out*, as we should turn a glove or a stocking; so that, the lining of the stomach shall become the external covering, and the external membrane the lining of the stomach; and yet, the functions of the animal seem to go on, as if they had not been in the least disturbed.

Having given this recapitulation, and stated the composition of the proximate principles of animals and plants, and the various methods of obtaining them, the author proceeds to describe the structure of the primary tissues. He divides them into two classes:—" 1st, those which are formed simply by the consolidation of fibrin; and 2nd, those which, either in their perfect state, or at some period of their formation, are in the condition of *cells* resembling those of plants." This description will be best stated in the author's own words:—

"It has been already stated that the clot which is formed by the coagulation of fibrin, even when this takes place out of the living body, has more or less of the fibrous character; and this is more distinct, the more slowly and firmly the coagulation takes place. Now, when fibrin is poured out upon a *living* surface, as it is in the production of false membranes as a consequence of inflammation, or in the repair of injuries, its coagulation takes place more slowly and more firmly, and its greater tendency to assume this regular arrangement is therefore still greater. There are several tissues which seem to have been produced in this manner. The one which most satisfactorily shows a structure that we may believe to have been produced by the simple coagulation of fibrin, is the membrane which encloses the white of the egg, and which forms the basis of the shell. If this membrane be soaked in water for some little time, it may be separated into numerous layers, every one of which presents a beautiful *matted* appearance, being composed of fibres that cross one another in every direction. The egg-shell itself, after its chalky matter has been removed by acid, exhibits precisely the same structure; and the most easy way of obtaining a sufficiently thin layer, is to take off the first delicate film that is seen on the *inside* of the shell (the lining membrane that surrounds the white having been previously peeled off) after it has been immersed for a few minutes in vinegar or any other weak acid. Now this fibrous membrane may (in the opinion of the author) be taken as a *type* or example of the fibrous tissues in general; but there is this difference between them,—that *this* has to serve a purpose merely temporary, and consequently no provision is required for its growth and renovation;—whilst *they* have to form a permanent portion of the living body, and must be nourished like the rest, in order that the continual *wear* may be counterbalanced, and that accidental injuries may be repaired; so that we find *them* traversed by blood-vessels, of which we do not meet with a trace in *it*. But as they are but little liable to change, the amount of vessels distributed through them is usually small.

Of the fibrous tissues produced in this manner, the one which is most abundant, in the bodies of all the higher animals at least, is the one termed *areolar*.* This is composed of a network of fine minute fibres, intermingled with thin plates of membrane that seem made up of fibres adhering together, side by side; and these are interwoven in such a manner, as to leave very numerous interstices and cavities amongst them, having a tolerably free communication with each other. These cavities are filled during life with a *serous* fluid;† and it is a necessary result of the communication between them, that if an accumulation of fluid takes place to an undue extent, as in dropsy, it descends by gravity to the lowest situation. Hence, the legs swell more frequently than any other part. In its natural state, this tissue possesses considerable elasticity; hence, when we press upon any soft part, and force out the fluid beneath into the tissue around, the original state returns as soon as the pressure is removed. But in dropsy, it appears as if the elasticity of the fibres were impaired or destroyed by their being over-stretched; for when we press with the finger upon a dropsical part, a *pit* remains for some time after the finger has been removed.

The structure of this tissue being disposed of, Dr. Carpenter points out the localities in which it is found, and the accidents and diseases to which it is liable, and its functions. This we shall pass over, as not being within the province of this Journal.

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* From the Latin *areola*, a small open space. This is the tissue commonly but erroneously termed *cellular*.

† A fluid resembling the *serum* of the blood, diluted with water.

Dr. Carpenter then goes on to describe the modifications of this tissue as seen in 1st, *serous membranes,* which line the different cavities in which the viscera (or organs contained within the skull, the chest, and the abdomen) are lodged; 2nd, the *ligaments,* which bind together the bones at the joints; 3rd, the *tendons* by which the muscles are usually attached to the bones; 4th, the tough *fibrous sheaths* that envelope and protect many of the most important organs; and, lastly, the *yellow fibrous* tissue which is highly elastic, and which is seen in the ligament of the neck of many quadrupeds, commonly known as the "*paxy-waxy,*" and which is also found in the walls of arteries, to which it gives its peculiar elasticity, and in some other parts of the body. The serous membrancs are produced by "the interweaving," to use the words of the author, of the fibres and shreds, so as to form a continuous sheet or membrane, having a smooth and glistening surface. By the union of fibres of a stronger kind, the firmer tissues are produced, viz., the 2nd, 3rd, 4th, and 5th of the above-named tissues.

It will thus be seen, that Dr. Carpenter does not agree with the opinions of the high authorities in developemental anatomy; to wit, Schwaan, Henle, Todd and Bowman, and others of equal note, that these tissues are invariably formed from cells. This is, indeed, a great irruption, into almost the universal belief in the origin of those tissues from cells; and, notwithstanding the high source from whence it emanates, requires, in our humble opinion, oft repeated and well-conducted observations, ere this method of explaining the developement of the areolar tissues should be received as a fact.

The following passage from Mr. Paget's report,* which is taken almost verbatim from Henle, will show that, in the opinion that the fibrous tissues above named are modifications of the areolar tissue, he agrees with Dr. Carpenter; but the same passage renders it equally evident, that, in the developement of these tissues, cells exercise a very important part in their formation, even if they do not form the entire origin of them; and what gives support to Henle's opinion, is the fact, that the remains of these cell-nuclei are always to be seen in the tissue by immersing it in acetic acid, which renders it more transparent than in its ordinary condition. There is no doubt, however, from many passages in Henle's work, that it is his opinion that these tissues are originally developed entirely from cells.

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* Report on the Microscopic Anatomy of the Tissues. Brit. & For. Rev. Vol. 13.

> "The common materials of which these tissues are composed, consists of fine, transparent, undulating, cylindrical filaments, from $\frac{1}{30000}$th to $\frac{1}{10000}$th of an inch in diameter, collected in fasciculi from $\frac{1}{3750}$th to $\frac{1}{7500}$th of an inch wide, the filaments in which are connected by a firm structureless *cyto-blastema*, and the fasciculi may either adhere, or, as in the case of tendons and other similar tissues, dense bundles are united by others of more loosely-connected filaments placed in their interstices. In different parts, either dense or loose fasciculi, or both, are woven into cords, membranes, &c. In certain situations, the *elements of the fasciculi* are bound together by small filaments of another kind, which, from their supposed origin, may be named *nucleus-filaments*, and which, Henle discovered by immersing fibro-cellular tissue in acetic acid, so as to make its proper fasciculi transparent. The latter, are thus seen to be severally, and sometimes collectively, constricted at pretty regular distances, by one or more dark filaments, very similar to those of elastic tissue, which either wind spirally round them, or encircle them with distinct rings. This arrangement is most frequent, when the fasciculi form cords. In the cases, e. g. where many fasciculi lie parallel, as in tendons and strong membranes, similar dark filaments run, not spirally, but straight along the interspaces between each two fasciculi; and in others, (in which the tissue is very lax) the dark filaments are very numerous, and run tortuously, or are even twisted up into little balls; other forms, discerned in fibro-cellular tissue, thus treated with acetic acid, are those of oval corpuscles, which commonly lie in rows, with their axes parallel to the proper fasciculi of the tissue, and, very often, they are connected by longer and more slender bodies, so as to form continuous, undulating, and spiral filaments. Henle, therefore, (to whom all the account of these fibres is due) has *little doubt, that the elongated nuclei* represents the early state of the dark spiral, and *interstitial nucleus-filaments;* and that, *on the other hand, there is a regular* gradation *from the latter, to the filaments of genuine elastic tissue*, for all the transitional forms are found mixed with the proper fasciculi, in different varieties of fibro-cellular tissue."

These processes of Henle's we have often tried, and, in all cases, our observations have corresponded with his.

Dr. Todd and Mr. Bowman,* after speaking of the two forms of fibrous tissue as they occur in isolated masses, go on to say, that, "their distribution through the body is far more extensive than this description would imply. In a diffused form, blended with one another in very varying proportions, and each one of them presenting a variety of modifications, they compose the *areolar tissue.*"

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* Physiological Anatomy, and Physiology of Man, by Robert Bentley Todd, M.D., F.R.S., and William Bowman, F.R.S.

There is no difference in opinion, as to all these tissues being modifications of each other; the only point of dispute, is in the order of precedence; Dr. Todd and Mr. Bowman describing the areolar as being a modification of the *white* and *yellow fibrous* tissues, while Dr. Carpenter describes these latter tissues as being derived from the areolar; but, in the mode of developement, the two former gentlemen appear disposed to agree with Schwaan, as the following passage tends to show:—

> "In the earliest period at which the areolar tissue can be examined, Schwaan has described it as consisting of nucleated particles, sending offsets on the opposite sides, and connecting themselves with others in the vicinity. The threads thus formed are at at first homogeneous; the longitudinal streaks, and the wavy character, appear subsequently. His description is drawn from the white fibrous element; but, it may be extended to the yellow also.
>
> "We have frequently observed *among the threads* of areolar tissue, taken from adult subjects, a *number of corpuscles, either isolated, or having very delicate prolongations* among the neighbouring threads. These *seem, with great probability, to be either advancing or receding stages of the tissue.*"*

And in another paragraph, Dr. Todd and Mr. Bowman state—

> "In the embryonic state, all the tissues are composed of cells, analogous in structure to the corpuscles of the blood. These are united together by a more or less abundant intercellular substance, which is either homogeneous *(hyaline),* minutely granular, or indistinctly fibrous. Some tissues retain, as their permanent character, this cellular structure; whilst in others, the cells undergo certain metamorphosis by which they are converted into forms, which constitute the anatomical elements of the adult textures."

Notwithstanding, however, the number of opinions in favour of the view opposed to that of Dr. Carpenter in the developement of these tissues, yet, the subject merits further inquiry. It is an undoubted fact, and one which every physiologist must have observed, that numerous filaments are always seen in, indeed, a filamentous tissue formed by fibrinous exudations. In the examination of the buffy coat of the blood, or of false membranes, the fibrous arrangement is to be clearly seen; and, although numerous corpuscles are seen lying between the filaments, yet these cannot be considered as cytoblasts, and are nothing more than exudation corpuscles in the case of false membranes, and colourless, with a few red blood corpuscles, in that of the buffy coat of the blood.

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* Op. cit. p. 75.

We would suggest to Dr. Carpenter, whether *original developement*, and *simple reparation* of these tissues, may not take place in two different ways; in the former from cells, and the latter by the consolidation of the fibrine, in the manner in which he states it does, in *addition to some modified process of cell-developement.* It should be observed, that the appearance of *repaired* tissues, after injuries, cannot ever be said precisely to resemble the original texture; and it may also be made matter of question, whether the fibrine in embryonic life be endowed with the same vital properties, which it afterwards acquires in the adult state; and, whether therefore, it then possesses the property of coagulating into fibres and homogeneous laminæ, as it undoubtedly does at the latter period.

Dr. Carpenter appears to think, "that fibrin may be consolidated, not merely into fibres, but also, into very thin layers of membrane, in which no trace of *structure* can be perceived. And, to this consolidation, he attributes the formation of the *basement* or *primary membrane.*

Dr. Carpenter next proceeds to the second group of tissues; those which are either composed of *cells,* or have had their origin in them—such, for example, as epidermis, epithelium, cartilage, bone, muscular fibre, nervous substance, &c. The author thus describes a cell, and points out the floating cells, which appear to perform such important functions in the animal economy.

"Between the animal and vegetable cell, there seems to be no other essential difference, than what relates to the chemical composition of the membrane which forms its wall. A cell is a minute bag or vesicle, formed of a colourless membrane, in which no structure can be detected; and having its interior filled with fluid of some kind. The original form of the cell is globular or oval; but when there are a number in contact with each other, and pressed together, their sides become flattened, so that, when they are cut across, no intervals are seen between them, but their walls are everywhere in contact. Of such tissue the whole plant, in the lower tribes of the vegetable kingdom, and all the softer portion in the higher, is composed. It does not form so large a part of the structure of animals; but we shall find that *their* vital functions are as much dependent upon the agency of cells as are those of plants.

In the blood or nutritious fluid, which circulates through the bodies of all but the very lowest animals, there may be seen a number of *colourless cells* floating in the liquid, and carried along in its current. These cells are also to be seen in the nutritious fluid which is taken up in the absorbent vessels (or lacteals) of higher animals, and which is gradually being converted into blood. They contain a number of minute granules, which appear to be the germs of new cells; and it is probable that the life of each parent cell has its appointed period, and that, when that period has elapsed, it bursts (exactly in the manner of the red-snow or yeast plant, VEGET. PHYS. §§. 48 and 55), and sets free these germs, whose developement into new cells has already commenced. Now as to the function of these floating cells, a considerable amount of evidence has been brought together to show,* that they are the real agents of the conversion of albumen into fibrin,—a change of the utmost importance in the animal economy.

In the blood of all the higher animals, we also find a vast number of minute discs, sometimes round, sometimes oval; these are not colourless, like the former, but contain a red fluid; and to this the colour of the blood is entirely due. These discs, too, are flattened cells; and they also seem to have a fixed term of life, and to be capable of reproducing one another, somewhat in the manner of the last. Their function appears to be that of serving as the *carriers* of oxygen from the lungs, into the tissues which need the supply; and of bringing back the carbonic acid, which is set free in the latter, to be disengaged in the lungs.

We see, then, that all the animal tissues may be considered as taking their origin in fibrin,—either *directly* in the fibrous network formed by its coagulation, or *indirectly* in the cells which are developed at its expense. The question next arises—what is the origin of these cells?

There is sufficient reason to believe that every living being is developed from a *germ;* no organised structure being able to take its origin (as some have supposed) in a chance combination of inorganic elements.

All the facts relating to the production of Fungi and Animalcules, which have been imagined to favour this doctrine, may be satisfactorily explained in other ways (VEGET. PHYS. §. 50, 51). Now the first structure developed from this germ, in the animal as in the plant is *a simple cell;* and the entire fabric subsequently formed, however complex and various in structure, may be considered as having had its origin in this cell. The cells of animals, like those of plants, multiply by the developement of new cells within them; each of these becomes in its turn the parent of others; and thus, by a continuance of the same process, a mass consisting of any number may be produced from a single one. It is in this manner that the first developement of the animal embryo takes place, as will be shown hereafter (Chap. xv). A globular mass, containing a large number of cells, is formed before any diversity of parts shows itself; and it is by the subsequent developement, from this mass, of different sets of cells—of which some are changed into cartilage, others into nerve, others into muscle, others into vessels, and so on—that the several parts of the body are ultimately formed. Of the cause of these transformations, and of the regularity with which they take place in the different parts, according to the type or plan upon which the animal is constructed, we are entirely in the dark; and we may probably never know much more than we do at present."

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* See a Paper by the author, on the Functions of Cells, in the British and Foreign Medical Review, for January 1843.

The author then goes on to describe the functions of the various cells, and their offices, in absortion, excretion, and secretion, which want of space, precludes us entering into. He then takes a general view of the animal kingdom, describing the functions of digestion, circulation, respiration, secretion, innervation, locomotion, and reproduction, in the various classes of animals. We make the following extracts from that part of the work which treats of reproduction, which, we are disposed to think, may be interesting to some of our readers, who may not be familiar with the various modes in which this function is performed in those animals, which so especially fall within the compass of this Journal.

"It has been elsewhere shown (VEGET. PHYS. Chaps. IX, XII), that, in the vegetable kingdom, there are two distinct modes, by which the propagation of most kinds of plants may take place;—the extension of the parent structure into new portions, which are independent of each other, and which can maintain their lives when separated from it;—and the formation of certain bodies, the developement of which does not commence, until they have been cast off from the parent,—these being nothing else, from the first, than the germs of new individuals. Now the bodies of the first class are known as *leaf-buds* in the flowering plants, and as *gemmæ* among the Cryptogamia; many of which last, as the *Marchantia* (VEGET. PHYS. §. 33), are furnished with a peculiar means of producing them. These buds may be developed in connexion with the parent structure, and may continue to form a part of it; or they may be removed from it (as in the process of budding, grafting, &c.,) and may be developed into new individuals. On the other hand, the bodies of the second class are known as *seeds* among the flowering plants, and as *spores* among the Cryptogamia. From the very first, these are destined to produce new individuals; and their developement does not take place, until they are cast off from the parent, which frequently (as in *annual* plants) dies as soon as it has matured them and set them free. Both these modes of reproduction exist in the animal kingdom; but the former is confined to its lowest tribes; and among these, we not only find a tendency to multiplication by buds, but an extraordinary power of regenerating lost parts, and even of reproducing the whole structure from a small portion of it.

This is the case, to a greater or less degree, in most of the radiated classes; and in none more than in the *Hydra*, already so frequently referred to. Not only will the body reproduce any of the arms that have been cut off, but, if it be cut up into a number of small portions, each of these will develope itself into a complete polype. Although this interesting little animal appears sometimes to reproduce itself by *ova* or eggs, yet its usual mode of propagation is by *buds*. From the side of the parent, a little knot or protuberance is seen to project; this increases in size, and assumes more of the form of a young animal; tentacula sprout from around its extremity, and a mouth or opening into its interior cavity is formed there; this cavity, which at first communicates with the stomach of the parent, is gradually shut off from it; the young animal begins to seize and digest its own food, whilst still attached by its base to the body of the parent; and at last the connexion is broken, and it becomes completely independent. Several of these buds, in different stages of developement, may sometimes be seen on the body of a well-fed Hydra, and occasionally the young ones themselves begin to produce a third generation, before they are separated from the body of the parent; so that as many as 18 individuals, in various stages of developement, have been seen sprouting from a single one. The Sea-Anemone has a power of reproducing lost parts almost equal to that of the Hydra; but it does not propagate itself in the same manner, its reproduction being always effected by ova. But these eggs are not unfrequently hatched, and the embryos partially developed, within the body of the parent; so that the half-formed young ones are ejected from its mouth, along with the undigested remnants of its food.

Among the compound Polypifera, we find the process of reproduction by budding carried to a great extent. The buds do not originate, however, from the individual polypes, but from the tree-like structure which connects them. This structure has powers of growth in itself, independently of the polypes, which may be regarded as the mouths by which it obtains its food; and when it extends itself, by commencing a new branch or twig, the polype-cell is first formed, and the polype itself does not appear until this is complete. A small portion of the gelatinous flesh peeled off from the stem of one of the stony corals, is able to reproduce the entire structure; for, absorbing nourishment from the surrounding fluid, it begins to deposit stony matter on the surface on which it may be lying, so as to lay the foundation of a cell; within this, a polype is speedily developed; and the stem and branches, with multitudes of new polypes are in time produced, by the continuance of a similar process.

In the *Star-fish*, a considerable power of regenerating lost parts has been observed; but this appears to be confined to the reproduction of the arms from the body. As it does not seem that the body can be regenerated from the arms, or from a half of itself, no multiplication of individuals can take place in this manner; and in this class there is no propagation by buds, as in the group just mentioned. In *Animalcules*, however, we find this process, or a modification of it, to be almost the only means of reproduction, which the beings composing that wonderful group possess; for the greater number of species never deposit eggs, but multiply themselves by the developement of buds, or by the division of their own bodies. The former process may be continually witnessed by the microscopic observer, in the common *Vorticella*, a bell-shaped animalcule, attached by a stalk, and abundant in almost every pool in which aquatic vegetables grow, especially clustering around the stems of Duckweed. Its various stages closely resemble those, which have been already described in the Hydra. But in many other species, the body of the parent divides into two equal parts, in each of which we see a mouth and other parts resembling those of the original. This division is gradual. A narrowing of the body along or across its middle (for the *fission* or cleaving sometimes takes place lengthways—sometimes transversely) is first seen; the indentation at the edge becomes gradually deeper, and at last the two parts hold together by but a narrow band, which finally breaks, and they become free.

But there are some species in which this process is stopped short, as it were, before the final separation; and in this case, a compound animal is gradually formed, by the union of many in one line or surface,—just as several cells remaining adherent together, but having independent powers of life, form the simple stalks of the *bead-mould*, or *yeast-fungus*. Some very remarkable compound structures are thus produced; and among them is one well known to microscopic observers, under the name of the *Volvox*, or *Globe-animalcule*. This is large enough to be discernible to the naked eye, and is a most interesting and beautiful object under the microscope. It appears in the form of a hollow globe with a transparent wall, inclosing other smaller but similar globes. The wall of each sphere is studded all over with minute green points, disposed at regular distances from each other; and when these are examined with a sufficiently high magnifying power, they are seen to be distinct animalcules, closely resembling in structure those which in other species are separate; each having its own cilia, by the vibrations of which, in connexion with the rest, the whole mass receives a rolling motion. They seem to be in some degree connected with each other, by means of vessels, which pass along the transparent glassy wall that supports them. The interior globes are young structures of a similar kind, which have had their origin in one of the animalcules of the parent mass. This, by dividing and subdividing, forms a new group of animalcules, which is at first attached to the interior of the wall of the parent structure; but after a time it is separated, and floats in its cavity; and, when it is mature, it is liberated by the bursting of the walls which inclose it,—the destruction of the parent being thus necessary for the propagation of the race. Not unfrequently a third generation may be seen within the second, previously to the setting free of the latter; and, under the brilliant light and high magnifying power of the solar microscope, even a fourth generation has been seen within the third."

We cannot conclude this notice of Dr. Carpenter's little work, without expressing the pleasure which we have derived from its perusal. We consider it to be a valuable contribution to natural science, and we can strongly recommend it to the notice of those of our readers, who are anxious to obtain some knowledge of animal physiology. In it they will find stated, in language as free from technicalities as possible all they can desire, in order to obtain an elementary knowledge of the subject of which it treats. The wood-cuts amount to 286 in number, and, considering the low price of the work, are exceedingly well executed; and, the "getting up of the work," is unexceptionable in every respect.

ON THE ULTIMATE DISTRIBUTION OF THE AIR-PASSAGES, AND THE FORMATION OF THE AIR-CELLS OF THE LUNGS.—BY WM. ADDISON, ESQ., F.L.S., ETC.*

THE manner in which the bronchial tubes terminate has always been matter of dispute among anatomists. Whether the cells composing a lobule freely communicate with each other, or whether each cell is distinct in itself, does not so communicate, and receives, therefore, the inspired air by a single bronchial ramification only. Reisseissen's investigations induced him to come to the latter opinion. From this view it will be seen by and bye that our author dissents, and from his researches concludes (and in this view, from our own observations, we, to a great extent, agree with him) that "the bronchial tubes, after dividing into a multitude of minute branches, which take their course in the cellular interstices of the lobules, terminate in their interior in branched air-passages *(Lobular passages)*, and freely communicating air-cells. The following is an historical summary of opinion upon this subject:—Malpighi† first described the *air-vesicles* of the lungs, and the *air-tubes* ending in them. Helvetius attempted to prove that these *Malphigian vesicles* were nothing more than common cellular tissue, diffused without order through the lungs, and that the air proceeding thither through minute air-tubes, not only passes easily from cell to cell, but likewise from the lobules into their interstices, and finally diffuses itself through the whole lung.

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* Read before the Royal Society, April 7th, 1842.

† M. Malpighi de Pulm. Epistol. 1 and 2, ad A. Borellum, 1661. Epistola 1 de Pulm. Published at the end of the Exercitat. de Visc. Struct. p. 220, &c.

Haller adopted the opinions of Helvetius, for he says—"the vesicles of the lungs do not receive the air by a single orifice from the windpipe, as into an oval grape or phial, but the air exhaling from the least branches, freely spreads from any one part of the lungs into all the rest, and returns again in like manner, neither is the cellular fabric of the intervals between the lobules shut up from the vesicles of the lungs, nor are the lesser lobes surrounded by any peculiar membrane."*

Reisseissen, in his work, *De Fabrica Pulmonum*, says—"that all the vesicles throughout the lung, or the air-cells, are blind extremities of the smallest air-tubes, and that these distributed in great number give to it its cellular texture."

Cruveillier, Majendie, and Bourgery, are of opinion that the air-cells freely communicate with each other, but do not give any minute description of the structure of the lung.

Mr. Addison having been engaged in investigating, by the microscope, the seat and nature of tubercles in the lungs, and having examined the structure recent and dry, failed to detect any tubes ending in blind extremities; on the contrary, he always saw in every section which he made, air-cells communicating with each other, and after repeating several of Reisseissen's experiments, and instituting others, came to the conclusion stated at the commencement of this analysis.

"In a fœtal lung," says Mr. Addison, "the *bronchial ramifications*, in the interior of a lobule, or the *intra-lobular ramifications*,† have a regular branched arrangement, subdividing in all directions, somewhat dichotomously, and terminating at the boundary of the lobule in closed extremities, or *culs de sac* terminations of the intra-lobular bronchial ramifications, many of them being seen in the interior of a lobule, lying against and pressing upon the sides of the adjoining branches; and Mr. Addison adds — "it is important to remark, that there are *no anastomoses* to be seen between the intra-lobular bronchial branches, each branch persuing its own independent course until it terminates in a closed extremity." Mr. Addison says—"in the fœtal lung air-cells do not exist, but when an animal respires, the entrance of air into the lungs inflates all the lobules to twice or thrice their fœtal dimension, and the *intra-lobular ramifications* experience a great and important change both in figure and character. The delicate membrane composing them opposes an unequal degree of resistance to the pressure of the air, which is very considerable, and it is consequently distended into little globular inflations, forming a series of communicating cells, which are immediately and permanently occupied by air-bubbles, in the mass of which all trace of the symmetry of their branched arrangement is entirely lost or obscured. The rounded inflations of one branch meeting on all sides, those of the adjoining branches are moulded by pressure into pentagonal or hexagonal forms, which are the figures of the air-cells." In the preceding passage the author does not express himself with his usual accuracy. The air-cells certainly exist in the fœtal lung, as much as any particular arrangement of the tissues exists in any other organ during the fœtal period—that *they* become distended into little globular inflations there is no doubt, and not the intra-lobular ramifications of which, in our opinion, the air-cells are but little pouches, if we may so call them, proceeding from their sides.

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* Haller (Von Albert) Elementa Physiologiæ: Cap. De Respiratione.

† The author here acknowledges that he has adopted the appropriate terms of Mr. Kiernan, which exactly express a very necessary distinction between the bronchial ramifications in the cellular interstices of the lobules which are always tubes, and those in the interior of the lobules, which are tubular only in the fœtus.

" Branched passages, however, still exist, and form a communication between the cells; but these passages are now neither tubular nor cylindrical. It is, therefore, necessary to distinguish them, and I have called them LOBULAR PASSAGES, an appropriate term suggested to me by Dr. Todd."

Now these passages are, in our opinion, nothing more than prolongations of the intra-lobular bronchial ramifications, and they cannot be said to be tubular or cylindrical, because their sides are irregular, broken up into numerous dilatations, or pouches, proceeding from them; in fact, the air-cells of the lungs. These cells, according to our observation, are as the author describes them, of a polygonal figure, and are, moreover, separated from each other by a partition which appears to be a duplicature of mucous membrane lying upon a partition of areolar tissue, derived from the inter-lobular septa. On their partitions run the vessels. But to proceed to the author's description.

> "The air-cells have not an indiscriminate and general intercommunication throughout the interior of a lobule. I have before observed, that there are no anastomoses between the intra-lobular bronchial ramifications, hence the air-cells formed along one branch do not communicate with those in another branch, except by means of their common opening into a larger branch, and so on for each branch respectively."

Abstracts from Journals, and Proceedings of Microscopical and other Scientific Societies.

MICROSCOPICAL SOCIETY.

At a meeting of the Society, held on the 18th of October last, J. S. Bowerbank, Esq., in the chair, a paper was read by Mr. E. J. Quekett "On an instance of monstrosity occurring in a moss." The author alluded to the fact that in "*flowering plants*," all parts connected with flower and fruit are but modifications of leaves, and that often, by cultivation, these several organs may be converted into petals, and frequently the conversion is not quite perfect, so that small greenish leaves occupy the centre.

Instances of this kind were noticed to be frequent in the class of plants above mentioned. Instances of a like kind have been, in a few cases, noticed among the higher orders of "*flowerless plants*," as the *Ferns*—where a tuft of small leaves has been found to occupy the place of the minute reproductive bodies *(sorus)* on the back of the frond.

It was mentioned that, from the facts of the capsule of a fern being the representative of a leaf under a modified condition, it had been supposed by Professor Lindley, that the parts belonging to the fruit of mosses might be formed out of leaves also.

The object of the paper was to confirm this opinion to a certain extent, by giving a description of a monstrosity of *Fortula fallax*, where the leaves at the base of the plant were of the usual kind, the fruit-stalk *(seta)* of the usual length and colour; but instead of a capsule with the normal condition of the teeth *(peristome)* round its mouth, there was an elongation of the *seta* of a green colour bearing many leaves arranged upon it alternately.

The specimens exhibited appeared to prove satisfactorily that the fruit of mosses is composed of peculiarly modified leaves, like the seed vessels of more highly organized plants.

A new form of microscope was explained by the inventor, Mr. Varley, which, from its being applicable for all purposes, for which these instruments are employed, embraced most of the present improvements, and was constructed with care to prevent many of the defects of some other kinds. Mr. Varley described many ingenious contrivances in its construction, but chiefly a new form of stage by which living objects could be easily followed and kept in sight, the motion being obtained by one plate, made to move on the surface of another by means of a lever. To prevent shaking, and ensure the movements being uniform, several exceedingly ingenious connexions between the plates were formed by guides united by ball and socket joints, which completely effected the intentions of the inventor.

The microscope, among its other recommendations, admitted of the application of Mr. Varley's graphic telescope for drawing objects placed on the stage of the instrument.

SPERMATOZOA OBSERVED WITHIN THE MAMMIFEROUS OVUM.

Dr. Martin Barry reported to the Royal Society, at its sitting, Dec. 8th, 1842, that he had distinctly seen spermatozoa *within* the ovum of a rabbit. The following is Dr. Barry's account of his discovery:—"On a former occasion (1840) I stated that at certain periods an orifice was sometimes visible in the thick transparent membrane *('zona pellucida')* of the mammiferous ovum, and that once I had seen an object very much resembling a spermatozoon in the orifice. But spermatozoa, so far as I am aware, have never been described as seen *within* the ovum of any animal. It may, therefore, be interesting to physiologists to be informed that about a fortnight since on examining some ova of the rabbit of twenty-four hours, from the Fallopian tube, in which the orifice above-mentioned was no longer visible, I unexpectedly discerned a number of spermatozoa in the interior; these ova were submitted to the inspection of Professor Owen, and I afterwards showed one of them to Professors Sharpey and Grainger, all of whom agreed that the spermatozoa were *contained within the ovum.*

Note by the Author.—The ova were in that state in which the essential part—the germ—consists of two cells; the spermatozoa lay around and between these cells, and when the ova were first examined, I thought I discerned traces of spermatozoa even *within the cells.* While the paper is going through the press, the opportunity is afforded me for mentioning that I have this day confirmed the observation above recorded; several ova from the Fallopian tube of another rabbit, in a somewhat earlier stage, having presented spermatozoa in their interior—*i. e.* (as in the first observation), within the thick transparent membrane *('zona pellucida')* brought within the ovum from the ovary.—31st of March, 1843.—*Phil. Trans. Part I.* 1843.

[This is a very interesting fact if true, and the confirmation of Dr. Barry's observation by Professors Owen and Sharpey, and Mr. Grainger gives additional weight to Dr. Barry's statement. Nevertheless, so important is the fact, and so agreeable to our preconceived notions, that we cannot divest ourselves of the conviction that this is one of those facts which we cannot implicitly believe until we see it. Dr. Arthur Farre, we believe, has seen a spermatozoon on the surface of the ovary, and we have ourselves seen it in this situation. In saying what we have, we by no means wish it to be inferred that we doubt Dr. Barry's veracity, but merely that he may possibly have been mistaken in his observation. We should like to be the organ of communicating any corroboration of Dr. Barry's observation which our readers may have it in their power to send us.]

ON FISSIPAROUS REPRODUCTION.—BY MARTIN BARRY, M.D. F.R.S.*

The author observes, that the blood corpuscle and the germinal vesicle resemble one another in the circumstance of an orifice existing in the centre of the parietal nucleus of both. He pursues the analogy still farther, conceiving that as a substance of some sort is introduced into the ovum through its orifice, which the author terms *the point of fecundation*, so the corpuscles of the blood may undergo a sort of fecundation through their corresponding orifice; and also that the blood corpuscles, like the germinal vesicle, is propagated by self-division of its nucleus; a mode of propagation which he believes to be common to cells in general. The nucleus of the germinal vesicle, or original parent cell of the ovum, gives origin, by self-division, to two young persistent cells, endowed with qualities resulting from the fecundation of the parent cell; these two cells being formed by assimilation, out of a great number of minuter cells which had been previously formed. This account of the process, which takes place in the reproduction of the entire organism, explains, according to Dr. Barry, the mysterious re-appearance of the qualities of both parents in the offspring.

Certain nuclei, which the author has delineated in former papers as being contained within and among the fibres of the tissues, he conceives to be, in like manner, centres of assimilation, from observing that they present the same sort of orifice, that they are reproduced by self-division, and that they are derived from the original cells of developement; that is, from the nuclei of the corpuscles of the blood. He considers that assimilation of the substance introduced into the parietal nucleus of the cell, is part of the process which propagates the cell; that the mode of reproduction of cells is essentially fissiparous, and that the process of assimilation prepares them for being cleft.

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* From Proceedings of the Royal Society.

A pellucid point is described by the author as being "contained in a certain part of the cell-wall, and as representing the situation of a highly pellucid substance, originally having little if any colour." This substance, which he considers as being primogenital and formative, he denominates *hyaline*, and ascribes to it the following properties. It appropriates to itself new matter, thus becoming enlarged; then divides and subdivides into globules, each of which passes through changes of the same kind. Under certain circumstances, it exhibits a contractile power, and performs the motions called *molecular*. It is the seat of fecundation, and it is by its successive divisions that properties descend from cell to cell, new properties being continually acquired as new influences are applied; but the original constitution of the hyaline not being lost. The main purpose for which cells are formed is to reproduce the hyaline; and this they do by effecting the assimilation which prepares it to divide; such division being thus the essential part of fissiparous generation.

The remaining part of the paper is occupied with a detailed account of these processes as they occur in the developement of the ovum, and also in the changes exhibited by the corpuscles of the blood, in which fissiparous reproduction also takes place, and the red blood-discs are converted into fibrin, and thus give origin to the various tissues of the organs. The same theory of fissiparous reproduction he also applies to the formation of the muscular fibre, in connexion with his belief that it is composed of a double spiral filament. Contractile cilia, he supposes, are also formed by the elongation of nuclei, the filaments proceeding from them in opposite directions. The author considers, lastly, the subject of the fissiparous reproduction of the Infusoria, and particularly of the *Volvox globator*, the *Chlamido-monas*, *Baccillaria*, *Gonium*, and the *Monadina* in general; and applies the same theory to gemmiparous reproduction, and to the so-called spontaneous generation of infusoria and parasitic entozoa.

RESEARCHES ON THE NATURE, SEAT, AND SPREADING OF PORRIGO DECALVANS.—BY M. GRÜBY.

Like many diseases of the scalp, the one named *Porrigo decalvans* has been traced by the author of the above memoir to a parasitic fungus.

"On examining attentively under the microscope, the white powder which covers the skin in *Porrigo decalvans*,* one will be astonished that it is formed entirely of minute cryptogomic plants. In submitting to the microscope the hairs furnished by individuals affected by this disease, there can be observed a large quantity of these minute fungi, which surround them on all sides, and form for them a true vegetable sheath, which extends from their origin in the skin as far as a distance of 1 to 3 "millimetres." †

In examining the sheath, of which mention has been made, by the microscope, its true vegetable composition can be witnessed. The minute plants are beautifully arranged and united, so as to constitute a solid vegetable sheath around each hair.

These plants are composed of branches, stems and sporules. The branches have their origin in the tissue of the hair, and constitute the internal portion of the sheath, whilst the sporules form the external.

The stem of these minute plants have an undulated form in the direction of the hair, their diameter being from $\frac{2}{1000}$th to $\frac{3}{1000}$th of a millimetre. The sporules are oval and of different sizes, varying from the $\frac{2}{1000}$th to $\frac{8}{1000}$th of a millimetre in diameter, are transparent, do not contain granules in their interior, and in water they become swollen.

This plant has been named by its discoverer *Microsporum* from the smallness of its sporules, with the specific name of *Audouini* "from the celebrated academician, who by his beautiful researches respecting the "muscordine," has very much contributed to direct attention towards the parasitic plants which destroy the living tissues of animals.—*Comptes Rendus, tom. XVII., August* 14*th,* 1843.

EXAMINATION OF THE "MOTHER OF VINEGAR."—BY MüLDER.

"Mother of Vinegar" is a mould plant which is developed in vinegar, and forms therein a thick leather-like coat, similar to the inflammatory crust, which covers the crassamentum of blood drawn from rheumatic patients. It is produced, not merely in, but from the vinegar; and as it forms, the acetic acid diminishes, until ultimately, water alone remains.

The mould-plant belongs to the genus *Mycoderma* of Persoon, or, *Hygrocrocis* of Agardh. It is one of the simplest vegetable formations, and belongs to the *Fungi* rather than to the *Algæ*. It is formed in vinegar, obtained both from wine and beer, but not in that procured from wood. It exists in unmixed vinegar, and also in vinegar, in which organic substances are preserved. These substances, however, contribute nothing towards the developement of the plant, but merely promote the production of a germ, or a cell, from which the mould-plant is formed, out of the elements of the acetic acid.* In all cases, whether organic substances be or be not contained in the vinegar, the *Mycoderma* has the same conformation and chemical composition."—*Pharmaceutical Journal, Oct.* 1843, *Translated from Annalen Der Chemie und Pharmacie, May* 1843.

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* *Porrigo decalvans* is a disease of the scalp, where the hair falls off in patches, leaving the skin nearly in its natural condition.

† *A Millimetre* is equal to .03937, or $\frac{1}{25}$th, nearly, of an English inch.

Microscopical Intelligence, &c.

APPEARANCE OF THE CUTICLE OF PETALS OF FLOWERS UNDER THE MICROSCOPE.

Those persons who have examined a portion of the cuticle taken from the back of a leaf, cannot have failed to remark the beautiful net-work of cells interspersed with "breathing pores" (*stomata*), of which it is formed. If the same examination be carried on with the petals, the markings are frequently seen to be more elegant, but the *stomata* rarely present,

To witness the appearance of the cuticle, a good example occurs in the cultivated species of "Geranium" (*Pelargonium*); and it is best to select a white flowered species,† and remove one of the two upper petals of the flower which are best suited for this purpose, then to take hold of the surface (the front), near the middle, with a pair of forceps, and strip off a piece of cuticle in a direction towards the margin. The piece obtained may then be placed on a moistened slip of glass and covered. When viewed with a ½ or ¼ of an inch object-glass, a structure will be made apparent, which is amongst the most elegant in the vegetable kingdom.

The field which is thus presented, is seen to be formed of a most delicate pattern of hexagons, the boundaries between which are ornamented with several influted loops in the sides of the cells, and in the centre of each marking is a star-like figure, apparently given by some corrugation of the membrane.

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* We very much doubt the correctness of the theory here expressed, that a "plant is formed out of the elements of acetic acid," and the *production* of the germ, is the result of the presence of organic matter. This appears too much like spontaneous generation. It is much more reasonable to imagine, that the sporules of this minute plant are everywhere; and, when they find a fluid, of a character fitted for their nutrition, they then flourish. No one supposes, that the "yeast plant" *Torula cerevisiæ* is formed out of the beer, but that it grows rapidly when added to it, converting the saccharine matter into alcoholic, just as this may act on the mucilaginous and alcoholic, and convert them into acetic acid.

That the "Mother of Vinegar" is a plant, was detected by Mr. E. J. Quekett, two years before the publication of Mülder's essay, and shown to many of his friends. It is seen to be composed of an infinite number of minute sporules, which cohere together as links of a chain, and otherwise forming a mass of leathery plates, often like superimposed pancakes. In the mucilage and vinegar exist numbers of the sporules in a detached state.—Editors.

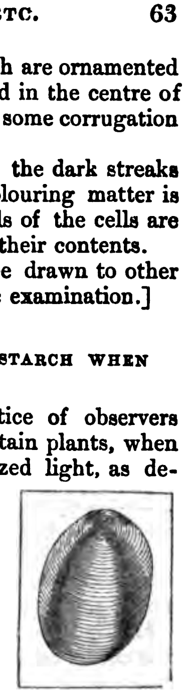
† If a red flower be selected, it should be deprived of its colouring matter by immersion for a short time in alcohol.

If the piece of cuticle have been torn across one of the dark streaks of the petal, it will exhibit the manner in which colouring matter is deposited in the cells of plants, showing that the walls of the cells are always transparent, and the colour is always given by their contents.

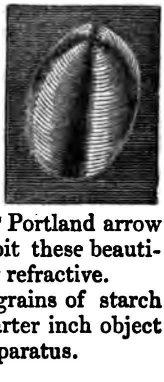
[Occasionally the attention of our readers will be drawn to other objects of this description, interesting for miscroscopic examination.]

ON THE APPEARANCES PRESENTED BY GRAINS OF STARCH WHEN VIEWED BY POLARISED LIGHT.

Few of those objects lately brought under the notice of observers exceed in beauty or interest the grains of starch of certain plants, when submitted to the microscope, and viewed by polarized light, as described by Dr. Pereira, in the Pharmaceutical Journal for July, 1843. For this purpose the larger grains, as those of "*tous les mois*," and potato starch exhibit the effect in the most striking manner.



When so examined, each grain presents a black cross, the arms of which meet at a spot, the (organic) centre of numerous oval lines, called the *hilum*. On revolving the analyzing, or that part of the polarizing apparatus next the eye, a quarter of a circle, the black cross disappears, and is replaced by a white cross, another black cross is now to be seen between the arms of the white cross, but much more faint in appearance. When a thin plate of *selenite* is interposed, so that the glass having the starch grains may rest upon it, every grain exhibits the phenomena that are common to crystalline matters under the same circumstances, being tinted with the richest hues of red and green.



The smaller grains, such as those of wheat rice, and "Portland arrow root" *(Arum maculatum)*, have not been found to exhibit these beautiful appearances, though they can be proved to be doubly refractive.

These appearances are readily seen by taking a few grains of starch from a very thin section of a potato, and placing a quarter inch object glass in the microscope, together with the polarizing apparatus.

DESCRIPTION OF POWELL AND LEALAND'S NEW MICROSCOPE.

See Plate 3.

A. The coarse adjustment for the body, which is obtained by a rack and pinion.

B. The fine adjustment.

C. Milled head that moves the stage to the right and left. It has a motion each way of three-fourths of an inch; consequently any objects may be made to traverse a square of that size, or an object three-fourth of an inch square can be observed, and few objects for microscopic inpection are larger than that.

D, D. Heads which move the stage at right-angles to the other, or up and down. There is one head to this motion on each side of the stage, in order that both hands may be employed at the same time, one on C and the other on the opposite side. This arrangement, when in action, produces a rotatory movement, and facilitates greatly the examination and search for animalcules and other objects. When the two heads C and D are used together, a diagonal motion is obtained, and when separate, the motions are at right-angles to each other.

E. Arm for holding the stops F, F, F. The stops are used when viewing opaque objects. To place them for use, first turn the spring hole into the centre of the stage, at which point it is made to stop; then turn the body aside, and push down the stop a little lower than the surface of the stage.

G. Mirror for illuminating objects. When the concave side is used, it should be raised about half way up the tube that carries it, in order that the rays of light proceeding from it may reach the object before crossing, which insures the most intense light. This side of the mirror is invariably used for opaque objects, together with the Lieberkuhn. At night it will be necessary to use the large condensing lens, which should be placed at about its focal distance from the lamp, with its convex side to the mirror, and adjusted till the rays of light fill the surface of the latter.

H. Spring-piece for holding the slides on the stage. The most convenient mode of placing the slides is, to push up the spring-piece sufficiently high to allow the slide to go on to the stage, and then depress it until it holds it firmly. Any number of slides of the same width may, after the spring-piece has been set, be put in without a repetition of that trouble. Should the slides be very wide, it will be necessary, in order to have the whole range of the stage, to observe if the centre of the slide corresponds with the line on the centre of the stage; if not, the situation of the slide must be altered until it does.

[In our essay "On the Application of the Microscope to Scientific Purposes" in our last number, we unintentionally committed an act of injustice to Dr. Carpenter, in leading our readers to assume that Mr. Bowerbank was the first to discover that the shells of the Mollusca possessed a cellular structure, and that Dr. Carpenter had taken up Mr. Bowerbank's inquiries and carried them on. This, we are informed, is by no means the case, as both these gentlemen made the discovery irrespectively of each other, and about the same time. The paragraph in question should have run thus :—" In the Mollusca it has been found by Mr. Bowerbank *and Dr. Carpenter*, that the shells, &c., and in the following sentence, Dr. Carpenter has *also* shown, &c."

The Editors take this opportunity of distinctly stating, that they will always be happy to rectify any errors which they find, on proper inquiry, they have unconsciously committed.]

[A Correspondent has pointed out a mistake which we unintentionally committed in our Hints to Microscopists in our last Number, as to the name of the manufacturer of the thin glass, which, instead of Dark, should have been Chance.—Ed. L. P. J.]

OBSERVATIONS CONNECTED WITH THE ANATOMY AND PHYSIOLOGY OF VALLISNERIA SPIRALIS.

By Edwin J. Quekett.

[Continued from page 37.]

Their structure is entirely composed of cellular tissue, which contains cytoblasts and a few granules. In the centre of every fibre there appears a dark line, which is owing to the central cells being surrounded by intercellular spaces, which are filled with air, and by that means cause, by reflecting the light, a dark line of considerable size. No vessel can be detected accompanying the cellular tissue in the centre of this organ.

Rhizome.—When plants are in their vigour, which is generally in July and August, this organ is thrown out and grows rapidly, and at the distance of every two or three inches gives origin to a new plant, and proceeds again at certain intervals to produce others. In diameter it is about $\frac{1}{12}$th of an inch, and bears a bud at its extremity.

It is composed internally of fibrous and cellular tissue, without trace of vessels, the fibrous being surrounded by the cellular.

The cells contain granules, and an immense quantity of *starch grains*, which are rather large, and present a hilum and concentric rings, as those of the potato.

Anatomy of the Organs of Reproduction—Peduncle.—This organ, as before described, assumes a variable length, from two to three feet, or even more, according to the depth of the water; is very flexible, and takes, instead of a straight form, a remarkably undulating and loosely spiral direction. When examined internally, it presents nothing more than a series of elongated cells, each containing granules and a cytoblast.

When this organ is examined for the purpose of discovering the manner in which the cellular tissue is arranged, so as to take on the spiral character, it is to be seen that the cells on the exterior have a diagonal axis, relative to the axis of the peduncle. The direction of the spiral taken by the peduncle is after the manner of a "right handed screw," which is much more marked near the base than near the flower.*

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* There appears something of fable connected with this plant, as with the Argo-

Spathe.—This organ is about three-fourths of an inch in length, and encloses the flower until a short time previous to its expansion; it is of a faint lilac hue, glistening, very delicate and membranous in its structure, which is composed of elongated cells, each of which contains granules and a cytoblast.

Calyx.—This organ is seated on the apex of the ovary, and is composed of three green sepals, which appear at first sight to constitute the whole of the floral apparatus, from the inconspicuous character of the petals. Their shape is bluntly lanceolate, and in substance more firm than membranous. The structure of these organs is entirely of cellular tissue, in the interior of which is the usual presence of granules.

Petals.—These in number, of course, are equal to the divisions of the calyx, but the disproportion between the two organs is excessive; the petals being scarcely perceptible, and only represented by very short pointed bodies, of a delicate character, and of a slight red tint. The structure of these minute organs is likewise of a cellular tissue of elongated form, and which does not contain so great a number of granules as are usually found in other portions.

Stigma.—This organ is exceedingly complicated, and relatively large to the size of the flower. It is divided into three divisions, each of which is deeply cleft; the entire surface is covered with numerous hair-like processes, which have a colour inclined to lilac, and present an elegant appearance, and apparently serve an important purpose besides entangling the pollen, by mechanically imprisoning air amongst themselves; so that in any accidental submersion of the flower, it is not drenched with water; therefore the pollen attached to these processes is not washed away. The stratum of air, like that around many aquatic spiders covered with hair, serving as a defence against the wetting of the surface.

Ovary.—This organ is cylindrical in shape, about an inch in

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naut; for the power of the plant to accommodate the flower to the surface of the water, does not depend on any uncoiling of a spiral to obtain length (for the flower stem is never perfectly like a cork-screw), nor is the buoyancy of the flower sufficient to extend the spiral, consequently it would be submerged if it depended on such a contrivance. It is by the great length of the peduncle that the end is effected in reality, and not as the ingenious are apt to consider it done in fable.

length, and $\frac{1}{15}$th of an inch in diameter. Its structure is made up of small elongated cells, which contain granules and also starch grains. Internally there is but one cell, and the ovules are attached to its parietes. There is a provision for completely detaching the seed vessel from the plant, by the decaying of the peduncle very close to the base—a provision which compensates for dehisence, or some other mode of dissemination in other plants.

Ovules.—The number of these bodies is very considerable, as they completely line the interior of the ovary. Each ovule is attached by means of a funiculus, and presents evidence of two coats (primine and secundine), and nucleus. The external exhibits the usual cellular character, and a foramen (exostome), nearly equal to the diameter of the ovule. The internal exhibits also the cellular appearance, and presents at its apex a foramen (endostome), twice as small as the former, through which the nucleus is seen. In many of the ovules the nucleus appears to protrude through both foramina, and presents a prominence beyond its proper contour, or the coats grow beyond the nucleus, the difference between which statements is difficult to decide.

The ovule in this plant affords an excellent illustration of the ordinary arrangement of parts in these organs; and from there being no pollen to exert its influence it can be examined before any of those changes occur, which end in the formation of the embryo.

Contents of the Cells.—These are generally of three kinds—a viscid fluid, granules (*chlorophylle*) and a cytoblast, especially in the young leaves, in which, also, as in the rhizome and seed vessels, is found a fourth, viz., grains of starch.

The fluid is extremely transparent, semigelatinous, and very adhesive.

The granules of chlorophylle have no character particularly different from those of other plants, except their being free to move in the liquid.

The cytoblast, which is apparently more vesicular than granular, has also perfect freedom of being carried on by the current, whilst in most plants this body is either absorbed or attached to the walls of the cell.

The grains of starch in this plant are much larger in the rhizome than in the leaf, presenting an oval form, and having near the smaller end a small spot, which is the organic centre of the several curved lines which are visible on each grain, as in the starch of the potato.

The occurrence of amylaceous grains in the cells of a leaf admits of an excellent opportunity for examining their developement, which is a point not yet satisfactorily established. From the observations made on this plant, it has been found that the formation of the grains of starch and chlorophylle is analogous to the developement of cellular tissue in many of the lower forms of *Fungi* and *Algæ*, and of the pollen of many plants, and also the sporules of mosses, and some other flowerless plants.

In watching the increase of some moniliform fungus, it will be seen that the terminal cell gives origin to another (without the aid of a cytoblast), by giving off from its exterior a small process or bud, which enlarges and ultimately arrives to the same condition as the parent, and is equally capable of performing the same action; or a cell becomes divided by a diaphragm, and eventually becomes two.

If the developement of the sporules of mosses and of *Pilularia* be examined, it has been found by my friend Valentine* that originally there is a parent cell, within which four others are formed, some or all coming to perfection when the parent one becomes absorbed, and the younger ones become loose in the cavity of the seed vessel as sporules.

Just these three methods of increase are to be seen among the granules of chlorophylle and starch (figs. 1 and 2). The latter showing the developement by the first, second, and third modes—though the latter is very rare—whilst the former more commonly exhibits the first and second.

These observations tend to prove that the amylaceous grains are developed like cellular structure in cryptogamic plants, and if this be correct, these bodies must partake of the nature of cells also, but filled with a substance which for particular purposes becomes hardened, after entering the cell. Their structure has often been a subject of dispute amongst vegetable anatomists. Raspail advocated the cellular character of the grain. Fritzche asserted that it was formed by a series of deposits around each other, and the whole not enveloped in a cell. Payen, the latest authority, maintains that it is a cell, and that the hilum is an aperture by which the contents enter, and become deposited at intervals; the stages of the process being supposed to constitute the curved lines that are seen on the grains of certain plants, as the potato, the oldest being the most external.

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* Linnæan Transactions, Part IV, Vol. XVIII.

This theory leads to the inference that the cell assumes its greatest size before the deposition commences, which is by no means certain; and further, most grains of starch have a conspicuous hilum, but very few exhibit the marking.

There can be no need of a pore for the contents of the cells either to get in or get out, and, with one exception,* no such thing has been found in plants as a cell with a perfectly formed opening at one extremity. Whatever may be the condition of the contents when the grain is perfect, there can be no doubt that they were liquid to get in, either by the walls or by a natural aperture; and when the plant requires the nourishment that these can afford, some solvent (diastase?) is formed that can bring the matter to such a condition so that it can be readily abstracted.

It is not evident that there is even an indication of a pore in the recent young grain, or even in the mature grain before it has been dried; but afterwards a minute dot represents the hilum, which is of a pink hue, a colour given it by some delicate structure decomposing the light.

The true nature of the structure of the starch grains of this and other plants can only be made evident by the application of heat, when mixed with water; if a slip of glass be taken three inches long, on which are placed some of the grains of starch from the rhizome of *Vallisneria*, which are to be moistened with water, and covered with another slip of glass one and a half inch in length; if the mirror of the microscope be now taken away, and a small lighted taper placed beneath the stage, which supplies both light and heat, the glass with the starch grains being laid upon it, and so placed that the centre of heat shall be applied to one end, when the object so arranged is viewed with a power of 300 linear, the following changes are seen to take place: no visible effect is seen until the heat has increased to a certain temperature, and then the change in the grains is very rapid. The first indication is shown by the hilum, which, if not very manifest before, assumes a red appearance; then two or three reddish lines proceed from it, when immediately after a deep serrated fissure follows the course of the lines, and the grain swells to three times its former size; the contents are now discharged, and nothing remains but the empty cell.* These changes are represented in fig. 3.

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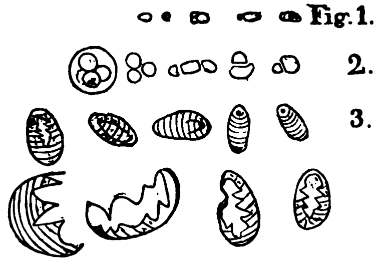
* The cells on the outside of the stem of *Sphagnum acutifolium* (one of the mosses entering into the formation of peat).



It is difficult to follow these changes with the eye, but having arranged the glass with the grains upon it as described, by looking towards the extremity not heated, when the taper is removed, you find examples of grains in all stages towards destruction, when it can be observed that the starch grain is a cell containing a viscid matter, soluble in water, and which, as well as the cell, is rendered blue by iodine.

The cell is easily shown to exist, by boiling a few grains of potato starch, and allowing it to remain at rest. If the deposit formed be examined, it is seen to be composed of empty cells.

Use of the Granules.—It is well known that the grains of starch are intimately connected with nutrition, but it is not ascertained that the granules of *chlorophylle* are applied to the same purpose; but it is not consistent with the usual proceedings of Nature to consider them colouring matter only, because, if colour be required, the membrane or the juices would be made to effect that end, as well as the complicated manner in which it is now supposed to be accomplished. There can be no doubt that the granules, besides giving the colour to the leaf, perform an important part in nutrition. By the action of iodine, which turns them brown, they appear to be cells which contain a gummy matter, which is well known to be requisite in the formation of other products, as well as of cellular tissue; and it can be seen that they have a developement analogous to the lowest of plants, and that they are constantly being produced, and they must be as constantly appropriated—otherwise, the cells must ultimately be full, which is never found to be the case.

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* These appearances are much more manifest if the grains of "tous le mois" or potato be used. The former clearly demonstrates, after bursting, that the markings seen on the grain belong to the envelope and not to the contents.

Circulation.—The grand phenomenon, that the microscope readily makes apparent in the leaves of this plant, is, that the cells contain numerous green granules, and an occasional cytoblast, which under certain conditions are carried with the juices of the plant in continued revolution around the walls of each cell, forming at the same time an object of striking character, as well as one of a most interesting series of physiological inquiries connected with the nutrition and growth of vegetables.

This movement of the contents of the cells is not peculiar to the leaf, being equally visible in most portions of the plant, as the roots, flower stalk, spathe, and calyx (in the petals it was not detected at the time of observation), and in the rhizome it appears to be absent, from the cell being so charged with amylaceous grains, which cannot from their numbers be moved with freedom in the liquid portions, so as to demonstrate that the fluid or granules revolve, as in the cells of the other organs.

The movement of the sap takes place in the same plane as the surface of the leaf. The granules coursing round the sides of the cells parallel to the edges, but further than this, no definite direction appears evident in the rotation of the contents of the cells in any organ, as in *Chara,* where the descending current of the cells of the branches is always towards the axis; for if any particular cell of the surface of the leaf be chosen, it may be found that the granules are revolving to the left, whilst in the one immediately in front, or on either side, they may be moving in a direction the converse. In the centre of the leaf, in the larger cells, the same opposition to any fixed law obtains; frequently two cells, one immediately in front of the other, have their contents moving in the same direction, but those of the third or fourth rarely consent to follow the same course.

The rotation in any given cell appears always to keep the same course, which is shown by stopping the motion, by exposing the part under examination to cold, and then reproducing it by bringing it into a warm atmosphere, when it is seen that the direction of the movement in each cell is precisely the same as it was observed at the first.

It does not appear clearly whether the granules only move as the fluid does, or whether they swim independent of it; yet it is somewhat extraordinary that either a fluid so viscid as that contained in the cell should revolve so freely, or the granules swim through it. The motion of the granules in the fluid seems to be shown by the fact, that some of the granules move more rapidly along the walls of the cell than others, and occasionally pass each other, but when in the centre they merely revolve slowly, as if turning on an axis, and it is probable that attraction between them and the walls of the cell, tends to place them in the position to course along the sides of the cell, as they are seen to do always when revolving with the greatest quickness.*

To account for this wonderful phenomenon in plants, many theories have been advanced, attributing it to physical causes, but these all fall short of a satisfactory explanation. *Electricity* has been supposed to be the agent, but if this were brought to exert any effect on floating inert particles, it would cause them to have polarities; they would be arranged like beads on a string, and entirely put a check to rotation. The theory of Dutrochet respecting *endosmosis,* has been supposed to account for the fact, but if it should do so, there is no reason why, when the plant is dead, the contents of the cell may not be kept revolving in contact with water, as this power is equally energetic, or perhaps more so, when dead membranes are interposed between fluids of different densities, as when the same action is effected through living tissues.

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* Frequently, when it is desired to exhibit the circulation in *Vallisneria,* disappointment very often takes the place of success. The best method of making the attempt, is to take a small portion of a young leaf and divide it in halves, by making a very oblique section in the plane of the leaf, by which means a transparent end is procured—should not the movement be visible, which is usually the case in summer, immerse it for a short time in water, between 70° and 80°. The piece should always be prepared an hour before it is wished to exhibit it.

This theory may be supposed to account for the movement of the contents of the cells of the entire plant by imagining, that as the nutritious matter taken into the system by the root is more aqueous than that which has been deprived of certain thinner portions appropriated towards the nutrition of the plant, and thus become more dense; we may then suppose on this theory, that there would be a tendency throughout the whole lines of cells vertically to equalize their juices in density, and consequently the passage of the thinner portions out, in one direction, and some of the thicker from the next in the opposite, may have the power of setting the fluid in any given cell in motion, as if acted on by two forces, one attracting the fluid in one direction, the other repelling it towards the opposite, but it is found that the leaf may be detached from the plant, and the movement will continue in any small fragment for days.

In order to ascertain whether the power of *endosmose* would cause a fluid to revolve, when that power is in action, the following experiment was performed:—a piece of glass tube, four inches long and one and a half inch in diameter, had both its ends tied over with a piece of animal membrane, and contained a saturated solution of salt; two wide mouthed phials were filled, one with distilled water having a small quantity of the nitrate of silver dissolved in it, the other having ordinary water, the mouth of each covered with membrane, and all three having floating particles of linen fibres added, to indicate any movement of the fluid. After the apparatus was adjusted, by bringing the membranes in contact, scarcely half an hour had passed before there was a heavy precipitate of chloride of silver in the one containing the nitrate, but there was not any in the one containing the salt, even after two days, showing that the thinner attracted solely the thicker, though evident interchange had taken place between the ingredients; no movement of the fluids was indicated in either vessel after forty-eight hours had elapsed.

The *duration* of this movement of the contents of the cells, in pieces detached for the purpose of observation, has been found to extend to a period of three and even four weeks, even in a fragment not more than half an inch in length,* therefore it would appear that a small mass of cells, perhaps a single cell, if it could be disconnected from the control exercised by the general vital endowments of the plant, has a special power residing in itself, by which it maintains a separate individuality, and is capable of carrying on the same function as it does now whilst connected with the whole plant, consequently we are to look for the cause between some power exercised by the walls of the cell on its contents—if *cilia* had ever been seen in the vegetable, we should not be long in assigning to them this office; but at present no agent, separated from a vital one, of which we know only the effect, can be supposed sufficient to account for this interesting phenomenon under all circumstances.

There can be no doubt that the rotation in the several species of *Chara, Nitella,* and other plants, in which the movement of the sap has been witnessed, is to be attributed to one and the same cause; this being granted, we have the power in *Chara* and *Nitella* of separating one cell (joint) of the plant from the remaining portion, and experimenting with this isolated fragment. It can be then seen, that the cause of the circulation is not dependent on the contiguity or continuity of tissues of the same character, as the sap moves and continues to do so, precisely as if it were still a portion of an entire plant; therefore if *endosmose* has any share in this phenomenon, it cannot be that the force is required to be exerted between two contiguous cells, but it can only then be with the water without and the thicker juice within.

It is found, that in this separated fragment, as well as in the entire plant, that the movement of the sap can be completely suspended by diminished temperature and by poisonous matters, such as destroy life in the animal kingdom without being destructive to the tissues, as opium, prussic acid, &c.*

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* A singular change of colour is to be observed, when a portion of a leaf of Vallisneria is cut off and kept in a sunny window in the same vessel with the plant from which it is taken; it then assumes a brownish red colour, whilst the other portion of the leaf attached to the plant keeps the usual green hue. This colour is due to the viscid fluid of the cells acquiring a red hue, and not from any change in the membrane or granules.

Though this change is effected in the physical characters of the sap, it does not interfere with the supposed vital property, as rotation of the contents goes on for two or more weeks after the discolouration has commenced.

The granules in the cells of these red leaves are not dispersed through the fluid as in the green leaves, but are congregated around the cytoblast, forming a globular mass, which revolves around the walls of the cell, in the same manner as when the granules and the latter organ were entirely separated.

The fact of this movement being paralysed by cold and narcotics and other poisonous agents, other matters remaining as before, clearly demonstrates that this action is carried on or superintended by some vital endowments of the cell and granules, of which we shall always probably remain ignorant, as it appears, like ciliary motion in animals, to be a phenomenon kept up without any evidence of the source of power. Muscular action has been supposed to be the cause of the latter, which is however only conjecture, and which experiment has proved to be without foundation.

Respiration.—It is well known that terrestrial plants require the action of air to prepare the crude sap for the immediate use of the vegetable, and that this is secured by the leaves having numberless openings (stomata) in the cuticle which lead into caverns, by which the air gets into close contact with the vessels and cells conveying the sap. In aquatics with submerged leaves, of course this method could not be adopted, but as their sap requires also the constituents of the atmosphere to be mingled with it, it is necessary that some equally effective method should exist. This is effected by the larger cells of the central portion of the leaf having a space completely around each, which is filled with air.

The question may be asked, how does this air become lodged in these intercellular passages? No doubt can be thrown on its presence; for if a leaf be examined under the microscope, dark lines, well known to the microscopist to be produced by air, are to be seen, as before described, around each cell of the interior of the leaf.

If a healthy young leaf be divided, whilst the vessel containing the plant be exposed to the sun, immediately that the section is complete, two or more bubbles will be seen on the cut edge attached to the plant. At intervals they will ascend through the water and be replaced quickly by others, and this escape will continue for many days—the bubbles which were large at first becoming smaller but more frequent, until at last they escape so rapidly, that there appears to be a miniature string of pearls extending from the cut-edge of the leaf next the plant to the surface of the water;—none of this escape takes place from the portion severed from the plant, therefore the inference is fair that this air is collected from the water and transmitted to the leaves by the roots.

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* The effect of ammonia on *Chara* is singular—disturbing the action, and exciting great commotion amongst the granules.

If a glass tube filled with water be inverted over the cut end of the leaf attached to the plant, a considerable quantity of the air can be collected; so much as an ounce by measure was collected from two leaves in six days. The disengagement entirely depends on light, on dull days being very scanty, and none whatever at evening and during the night.

On agitating the air with lime-water no diminution of its bulk was observable, and on placing the red-hot end of a match previously lighted, no brilliancy of combustion was evident; therefore, from such a rude analysis, it is to be supposed that the air which is collected from the exposed passages of the leaf was simply atmospheric.

Remarks.—The observations here detailed are sufficient to prove the power with which cellular tissue is endowed for carrying on all the purposes of vegetative life. In *Vallisneria spiralis** we have no other agent to effect any of the functions of nutrition or reproduction, which leads to the inference that, though vascular tissue is more frequently superadded in other plants, yet all the important duties are performed through the agency of cells: the vessels may conduct the materials, gaseous or liquid; but it is the office of the cells to elaborate, and lay down the foundations for all the superstructures, which they preserve by their perpetual developement.

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* The plant above described has been intentionally called *Vallisneria spiralis*, on account of its being so well known by that name, which was given by Linnæus; but it has been found that this appellation included two plants very different from each other in the shape of their leaves. Therefore, for distinction, the Italian plant, which differs from the other in the shape of its leaves, has been termed by Sprengel *V. Micheliana*, and the plant under consideration *V. Jacquiniana*, which is a native of France, East Indies, and South America.

In the movement of the granules within the cells, it can scarcely be imagined that the sole power of the granule to creep along the four sides of the cell which are in the same plane, should altogether be inherent in itself; for should it be, there is no apparent reason why it should not at some periods take a course at right angles to the one always observed; but it is never found to do so, the cell no doubt having a material part of the duty to perform of this interesting phenomenon, and determining the course of the granules in the direction of its longer axis.

The "frog bit" (*Hydrocharis morsus ranæ*) belongs to the same order as *Vallisneria*, and is equally favourable for exhibiting the movement of the granules in the cells in most of its organs; and it is not improbable, that as all the plants of the order are aquatics, that the same fact may be detected in several other instances.

REMARKS ON MR. WHARTON JONES' OPINION OF MUSCLE BEING A NEURO-MAGNETIC APPARATUS.

By H. Letheby, M.B., A.L.S., Curator to the Museum, and Lecturer on Comparative Anatomy at the London Hospital.

In the Medical Gazette, October 20th, 1843, there is a paper by Mr. Wharton Jones, entitled, "*Muscle, a Neuro-Magnetic Apparatus*," the author being of opinion, that muscular fibre consists of a series of pieces in the form of discs, as first pointed out by Mr. Bowman; not immediately adherent to each other, however, but, as he finds, held together by an intervening substance, so yielding and elastic as to admit of a very close approximation of the discs to each other, or their separation to a certain extent. These discs he considers analogous in their nature to *electro-magnets;* and he proposes to call them *neuro-magnets,* inasmuch as the relation of the nervous influence to them appears to him to be essentially the same as that of the galvanic influence to the soft iron forming common electro-magnets.

Now, although I have every belief in the identity of the nervous and electrical forces, and that the termination of all physiological inquiries will be to this end; yet I am not so sanguine of the discovery of its mechanical application in the living organism; and I think we are much too premature in the present stage of our investigations, in attempting to point out these applications of a force which is, after all, not yet decided on; and it is on this account, as well as that the subject may have more careful consideration, that I put forth the following objections to Mr. Wharton Jones' views:—

1st. *It is not yet decisively proved that the nervous is an electrical force.*—Although we have many reasons for believing so, yet not one of them is of a positive character, but they are rather inferred from the great similarity of the two series of phenomena. One point has yet to be made out, and that is, a positive evidence of the traverse of electricity along the *nerves* during muscular action. In a succession of experiments which have recently occupied my attention with a view of determining this, I have been wholly unable, even with a most delicate galvanometer, to detect any evidence of electricity traversing the nerves during the performance of the vital functions; yet there is no difficulty, as in Matteucci's experiment, in obtaining ample proof of the transit of some force, which is capable of exciting muscular contraction, even in the limb of a second animal.* About the subsequent experiments of the same author I am not, however, so clear,† and therefore I have not quoted them.

2ndly. *I can see no analogy whatever between the arrangement of the loops of the ultimate nervous fibres and the coil of a magneto-electric machine.*—Connected with this point there is but one proposition to bear in mind, and it is, that the magnetic polarity is exerted at right angles to the electric current, and by a consequence, as in the coil, the nerves should at all times be detected pursuing a transverse or spiral course to the muscular fasciculus. Now, as far as my observations have hitherto gone, nothing can be more irregular than the position and distribution of these nervous loops.

3rdly. *How is it that muscular fibre retains its property of*

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* Comptes Rendus, No. 17, Oct. 1842.

† Ibid. No. 4, Jan. 1843.

contraction for a short time only after death?—If it depended upon this physical condition or arrangement of its discs and the nerves, a current of electricity sent along them any time before absolute decomposition, ought to give rise to muscular contraction; but we know that such is not the case. A few minutes after death is often sufficient to destroy its property, or, in other words, the moment vitality truly ceases, then this property of contraction ceases also.

4thly. *The views are not sufficiently borne out either by the anatomical or the physiological conditions of the muscular fasciculus*—for it is not at all a determined proposition, that the muscular fasciculus *is* composed of a series of discs contained within a sarcolemma. Barry believes, and with just as much reason, for both opinions are merely inferential, that the transverse striæ of voluntary muscle are produced by the interlacings of a fibre; and I have an equal warrant for asserting, that they are due to rugæ or plaits upon the sarcolemma; for it is not every fasciculus of the same muscle which exhibits them; while, on the other hand, the longitudinal elements are always seen. And then, again, it cannot account for the contractions of the involuntary muscles, for these have no such discs, except the muscular fibre of the heart and œsophagus. But admitting this discoid arrangement, it does not explain how it is that the fasciculus should swell out at the points of contraction—the discs should be merely approximated. And then, again, I cannot see what tendency such a force can have in the breaking up of the discs, as Bowman has shown is the case in *Tetanus*, &c.* This *very elastic intervening substance* ought to yield in every way.

5thly. *And above all, how is it that the muscular fasciculus is still seen to contract even when removed from the body, and consequently from nervous agency?*—No magnet of soft iron produced by a coil retains this property when away from the influence of its electrical currents.

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* Phil. Trans. Part I, 1841, p. 69.

Reviews and Analyses.

Cours de Microscopie, complementaire des Etudes Medicales. Anatomie Microscopigue et Physiologie des Fluides de l'Economie. Par Al. DONNE, Docteur en Medecine, Professeur Particulier de Microscopie, &c.—Bailliere, pp. 550, 1844 (!)

Course of Microscopy, complementary to Medical Studies. The Microscopical Anatomy and Physiology of the Fluids of the Œconomy. By Al. DONNE, M.D., Private Professor of Microscopy, &c.

FROM his numerous papers, published in periodicals, and in proceedings of societies, M. Donné has long been known as an assiduous inquirer, by the aid of the microscope, into the intimate structure of the different bodies found in the fluids of the œconomy, as well as into the minute appearances, or characters of these fluids generally, viz.:—blood, mucus, pus, sweat, bile, urine, milk, chyle, lymph, &c. It is on this account that we hasten to lay before our readers an analysis of his recently published work, which contains, in a connected form, all the observations which the author has published upon these subjects for the past ten years, and the truth of which, he says, subsequent and more matured observation has confirmed.

We shall pass over M. Donné's description of the successive changes which take place in the blood, on its removal from the living body; and his explanation of these changes on mechanical principles, as they do not differ, in any important particular from the description given of these changes in our systematic treatises on Physiology, and we shall therefore proceed at once to the author's description of the three forms of particles held in suspension, and circulating in the blood:—first the red globules, or blood-globules, properly so called; second, the white globules; third, the *globulins.*

"The little solid bodies," says M. Donné, "dispersed in the blood, are distinguished by regular and constant forms, and a complex and determinate structure; they have a true organization, and may even be said to possess a peculiar life, for they have a commencement, a developement, and an end; they pass through different successive transformations, from their origin up to the moment when they have accomplished their evolution, and fulfilled their *final end*, which is to constitute the true organizable fluid, the *bildungsflüssigkeit* of German physiologists. The blood globules have only a transitory condition, during which they exercise some special action upon the organism ; but they do not serve, as stated in an ingenious theory, which for a long time reigned in the physiological schools, to form by the union of their nuclei, as a row of beads, the organic elementary fibre; they do not directly conspire to the developement of the organs by their mechanical adjunction, and never do we see them passing out from, or permeating, the walls of the vessels, in order to be incorporated with the tissues. In a word, the globules suspended in the blood, are not the last term in the elaboration of the sanguineous fluid."

The author first considers the form of these different kinds of globules, their dimension, their structure, and their intimate composition; then points out how they comport themselves with external and chemical re-agents, and concludes this portion of his work by detailing the most prominent character of each. As some of our readers may not be acquainted with the modes usually practised for obtaining and examining small quantities of blood, we shall transcribe the following plan recommended by M. Donné, which is that almost invariably practised :—

" It consists in placing a very small drop of blood, about as large as a pin's head, upon a slip of glass, then placing upon it another slip of thin glass (such as that described in our " Hints, &c."), and extend it into a very thin and transparent layer, between the two slips. In this state the substance is well disposed in order to be submitted to the microscope, and observed with a magnifying power of three or four hundred times linear. The blood globules are thus clearly seen separated from one another, or united *en chapelet*, but not collected together in confused masses. A prick made at the end of the finger is the most convenient way to procure human blood, when wanted for examination. The chemical re-agents are usually applied by means of the capillary attraction between the two surfaces of the glass, by depositing a drop of the re-acting liquid at the border of the superior glass, where it comes in contact with the inferior slip of glass."

The following is the author's description of the red particles, which he erroneously calls globules :—

" The form, dimension, and structure of these globules, differ according to the class of animals to which they belong; circular in the blood of the Mammalia, and elliptical in that of birds, fishes, and reptiles. In all animals they are flattened; we never find them swelled out in all directions, or spherical. They contain the colouring matter of the blood, and it is to them that this liquid owes its red colour.

" The blood of Man, which we shall take as the type of the blood of Mammalia, offers some globules which are circular, flattened, and swelled, or thickened towards its circumference, and somewhat depressed in the centre, which appears clear or obscure, according as we approach the object, more or less towards the object glass *(as we increase or diminish the focal distance)*. A very just idea of their form will be conveyed by representing them as little soft lenses, of which we have depressed the centres by a slight compression.

"From this form we can conceive that a blood globule, rolling in a liquid must present itself alternately by its face, and by its edge, like a piece of money.

"This form, and this flattening of the blood globules, so easy to be detected on the first microscopic inspection, were not recognised at first, and many observers have described these globules as being little spheres. This error belongs less to the imperfection of the instruments which were then employed, than to the proceeding which those observers had recourse to, in order to show these objects under the microscope. They allowed, as we do sometimes at present, and as is necessary in many cases, the blood to remain with water; but, ignorant that the first effect of the contact of water upon the blood globules of the four vertebrated classes of animals is to modify their form, to swell them out in one direction, and diminish them in the other, in a word, to render them spherical; they considered this as their primitive form, and one really belonging to them. This is not the only example of error committed from the action of modifying agents, and of water in particular, of which we may have not known the effect. We find an analogous fact to this, in the globules of the blood of birds, to which we attribute an abnormal form at their origin in the embryo."

After alluding to the difficulty of accurately measuring these objects, on account of our imperfect instruments (micrometers), M. Donné states, that the globules of human blood vary from the $\frac{1}{120}$ to the $\frac{1}{123}$ of a millimetre ($\frac{1}{3120}$ to $\frac{1}{3178}$ of an English inch). These globules are endowed with great flexibility—they extend and elongate themselves, and fold up in every direction, and assume again their original form with perfect elasticity. These changes are readily seen in the blood globules running between the two slips of glass, the effect of the capillarity—or even during life, when observing the circulation in the frog's foot, or any other transparent part. This property of altering their forms as above described prevents our freeing the liquor sanguinis from them by filtration, by enabling them to traverse the capillary canals in the filtering paper.

M. Donné considers a blood particle of Mammalia to be a circular, flattened, and coloured vesicle, eminently flexible, and containing a semi-liquid matter, and that this matter is of an albuminous nature from its solubility in water, in acetic acid, and ammonia, and from its being coagulated by nitric acid.

He denies that the blood particles of Mammalia have a central nucleus, and attributes the prevailing belief of the presence of a nucleus in the blood particles of this class of animals as the result of the examination of the blood of the frog, which has nearly always served as the type in microscopic researches; and the appearances observed in it from the application of re-agents have, by analogy, been extended to other kinds of blood.

The singular property of the blood discs to cohere together by their flattened surfaces, like a number of pieces of money superimposed upon one another is one, according to M. Donné, belonging only to the circular particles of the Mammalia, and not to the oval particles of the birds, fishes, or reptiles. He says, "they are grouped together, on the contrary, in irregular masses, and in all directions."

M. Donné alludes to the singular fact discovered by M. Mandl (and Mr. Gulliver we believe), of the blood particles of the family of chamelions being of an elliptic form, like those of birds, &c.; but this anomaly, says M. Donné, relates only to their form, and not to their intimate structure, which agrees with those in the blood of other mammiferous animals, and they do not therefore contain a nucleus.

It will thus be seen that M. Donné agrees in the form, size, and properties of these particles with the majority of observers in this country, but does not agree as to their intimate structure, and exhibits a remarkable ignorance of the effects of numerous re-agents in making apparent the central nucleus of Mammalia, and even of Man, as described by numerous observers of this country as well as in Germany.

It may not be considered out of place here, if we give a short account of the different opinions held by physiologists upon the structure of these minute and wonderful bodies. Many of these opinions will be quoted for their absurdity only, for, with our improved optical instruments, it is difficult to conceive how such absurd opinions could ever have been entertained.

The red globules were discovered in the blood by Malpighi, and shortly afterwards by Leuwenhoek, in 1673, who believed that their form in Mammalia was globular, at the same time that he recognized their flattish and oval form in birds, reptiles, and fishes. He detected also the oval spot in the centre.

M. de la Torre, and some few others of his time and subsequently, imagined that they saw an opening in the centre, and accordingly concluded the blood particles to possess an annular form. Next in date (1774) comes that excellent observer, Mr. Hewson, who considered these particles to be vesicles having a flattened and bi-concave form, and possessing a central nucleus in their interior. Bonn, Bernoulli, and Keil, considered them to be globular vesicles filled with air.

Dr. Young, Dr. Hodgkin, and Mr. Lister, agree with Hewson in describing the blood corpuscle of Mammalia as resembling a bi-concave lens, but they differ from him in considering it to be devoid of a central nucleus. Müller, Schultz (who believes them to be the true respiratory agents), Milne Edwards, and most physiologists of the present day, agree with the description of Hewson.

Dr. Martin Barry, in a series of papers read before the Royal Society, supposes that he has detected a very complex organization of the red blood corpuscles. He is of opinion that he has observed within it a *wonderful* flat filament, which in Mammalia, including Man, is frequently annular; and sometimes this ring is divided at a certain part, and sometimes one extremity overlaps the other, which is very evident in the case of birds, amphibia, and fishes, in which this filament is of such length as to constitute a coil. This filament, Dr. Barry thinks, is formed of the discs contained within the blood corpuscle, and in the Mammals the discs entering into its formation are so few as to form a single ring; and to this he ascribes the bi-concave form of the corpuscle in this class, and the frequent annular form of the filament it produces. In the other Vertebrata, the discs contained within the blood corpuscles are too numerous for a single ring, and they consequently form a coil. The nucleus of the blood corpuscle, in some instances, resembles a ball of twine, being actually composed at its outer part of a coiled filament.

Dr. Barry has not only detected this spiral (*crooked*) filament in the blood corpuscle, but in every fibrous tissue occurring in the animal and vegetable kingdoms, from the top of the head, commencing with the areolar tissue subjacent to the basement membrane of the skin, down through every tissue, presenting the slightest fibrous appearance, to the same tissue in the sole of the foot; and in plants, from the rootlets up to and in the several parts of which the flower is composed. It should here be added that Mr. Wharton Jones, in a paper to the same learned body, takes upon himself to state that Dr. Barry has generally confounded the white blood corpuscle with the red, and concludes that as all Dr. Barry's premises are erroneous his conclusions must necessarily be unfounded. As Dr. Barry is the only observer among so many who, from his own investigations and manipulations, has seen this filament, we warn our readers to investigate the structure of the red blood corpuscle for themselves, ere they make up their minds to believe that this filament exists in it.

Majendie agrees in opinion with our author, both in denying the existence of the central nucleus in the red blood corpuscle of Mammalia, and admitting its presence in that of birds, fishes, and reptiles.

The following authorities have observed the nucleus in the red particles of Mammalia, by means of the application to them of water and acetic acid:—Hewson, Müller, Milne Edwards, Dr. Rees, Mr. S. Lane, and a host of others of the present day; and it is only suprising, therefore, that so correct an observer as M. Donné confessedly is, should have failed to observe it.* The manner of pursuing the investigation of those bodies in birds, fishes, and reptiles, as described below, would show that he possesses every requisite for witnessing the series of changes which takes place in these bodies, which the researches of others have enabled them to detect.

"The globules of the blood of the frog are, as we have before said, elliptical, flattened, very thin at the edges, and somewhat thicker in the centre, instead of presenting a depression as in Mammiferes; they are much larger than these last, the greatest diameter being not less than $\frac{1}{37}$ of a millimetre ($\frac{1}{962}$ of an English inch), and the smallest $\frac{1}{75}$ of a millimetre ($\frac{1}{1950}$); they present themselves as well by their faces as by their edges when rolling upon the slip of glass, and elongate, and fold according to the obstacles which they meet with, and do not affect any regular order in the manner in which they are grouped together at the moment when they cease to be in motion. At first we do not distinguish the obscure point in the centre, and it is only after the lapse of a certain time from their being taken from the vessels, and their deposition upon the glass, that we begin to recognise an appearance of the central nucleus; the nucleus becomes very distinct and decided from the addition of a little water, and if the quantity of this liquid be sufficient the form of the globules quickly changes; they lose their elliptic and flattened form to become spherical, and this modification is effected by a swelling or distending of the globules in one way, and by a shortening of their great diameter. It then becomes evident that they are formed of a vesicle enclosing in its interior a solid nucleus; whether this structure be primitive or secondary—whether the nucleus be the result of the action of the water, or of a coagulation of the interior substance, or whether it pre-existed always, at this moment one has plainly and really under the eyes a little body composed of a soft and spherical vesicle, containing a nucleus which is displaced from the middle of the vesicle, and becomes, in effect, very soon eccentric; it approaches the wall of the cell, escapes from its envelope, and when we can follow with care all the successive degrees of this operation, we recognise on one side the nucleus, and on the other the plaited, rumpled vesicle, which ends by becoming dissolved, and disappearing in the liquid; in this case there is no ground for mistaking the complex structure of the globules, or of denying the existence of an envelope, and of a nucleus, since we have had under our eyes these two parts, distinct and separate.

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* This is, we are aware, a very cursory summary of the opinions upon the structure of the red blood corpuscle, but with such limited space as could be spared in this Journal, it was impossible to enter more fully into them. We are not without hope, however, that sufficient has been stated to give our readers a very good idea of the difficulty of the subject, and of what has been done in this part of anatomy.

"The nucleus resists for a much longer time than the envelope the action of water, and it requires even a long maceration in a sufficient quantity of this liquid to effect its entire solution.

"Acetic acid acts in a much more prompt and palpable manner;—a small drop of this acid, extended by capillarity between the slips of glass which contain the blood, immediately attacks the envelopes of the globules, condenses the central nucleus, contracts it, and renders it very apparent in the middle of the transparent vesicle which surrounds it; in a few instants the envelope fades, becomes dissolved, disappears, and nothing remains except the solid, elliptic, opaque nuclei, which resemble small grains, or grains of pollen swimming in the liquid. It is necessary to follow the action of the acetic acid attentively, in order to detect these different phases of the phenomenon; for at the moment that we are speaking, at the last term of the action, we perceive only the nuclei, and nearly lose all traces of the cells or envelopes, which have almost entirely disappeared.

"Ammonia, as has been witnessed by nearly every observer, rapidly dissolves the globules, both envelope and nucleus."

[With respect to the effects of different re-agents upon the red blood corpuscles, a very good account may be found in an elaborate paper on the structure, &c. of those bodies, by Dr. Rees and Mr. S. Lane, in Guy's Hospital Reports for 1841, we believe. In our next we shall resume our account of M. Donné's work, and give an analysis of his views of the structure of the white blood corpuscle, and those other minuter bodies which he has denominated *globulins;* and in the following Numbers his views of the bodies found in the other fluids of the œconomy.]

Abstracts from Journals, and Proceedings of Microscopical and other Scientific Societies.

MICROSCOPICAL SOCIETY OF LONDON.

At a meeting of the Society, held on the 15th of November, J. S. Bowerbank, Esq. in the Chair, a paper was read by Mr. A. White describing the application of a lever movement to the stage of a microscope.

It consists of a lever, to the shorter arm of which a ball is firmly screwed, moving in a socket formed by the upper plate of the stage, and a cap, which is a brass plate secured by two screws to that plate. This lever passes through a perforated ball, moving in a socket formed by an arm attached to an immovable part of the microscope, and a cup formed and secured upon the arm, as in the former instance.

This lever is about five inches long, having the longer arm equal to three, and the shorter to one. This proportion, however, varies according to position, and hence the necessity of a perforation in the second ball to allow for it. This construction affords great facility of motion in every way, and the range in the instrument exhibited was three quarters of an inch.

Mr. Jackson read a paper describing an improvement in the mode of applying a divided glass micrometer to the measurement of objects under examination, described by him in a former paper, read September 3rd, 1841.

The micrometer is mounted in a thin brass frame, which slides easily (under a spring) through slits in the opposite sides of the eye-piece, which slits, when not in use, are closed by a quarter revolution of an internal tube, having similar slits. Its divisions are $\frac{1}{40}$th of an inch apart, with one of the spaces divided into five by finer lines, which, as they may be readily brought by the sliding of the micrometer into contact with the magnified edge of the object to be examined, afford great facility of measurement. He concluded with some observations relative to the method of using this instrument, and of finding the value of its divisions, under the various circumstances in which it may be employed.

A paper by J. S. Bowerbank, Esq., F.R.S., &c., entitled "Additional Observations on the Structure of the Shells of Molluscous and Conchiferous Animals," was read. The paper, of which this is a continuation, was read before the Society on the 18th of January last, and the present observations relate to the mode in which wounds in the periostracum are repaired, which differs in many respects from the analogous operation in the shelly structures. A shell (*Solen vagina*) in Mr. Bowerbank's possession having had this organ pierced in a great number of places afforded, upon examination, the means of ascertaining the manner in which nature operates in making up deficiences in that important membrane. In this case the wounded organ is so situated as to preclude the possibility of the ordinary mode, viz. the exudation of a layer of coagulable lymph, in order to form a new basement membrane being followed, and consequently another course is pursued. The inner layer of the periostracum gradually advances from all sides over the wounded surface, until it unites in the centre of its area. This new membrane is at first clear and pellucid, but after a short time minute vesicles, molecules, and cytoblasts, appear in various parts of the surface together with small patches of minute vascular tissue. These spherical cells gradually increase in size, assuming the form of collapsed vesicles; as their number increases their outlines become indistinct, until at length they form an even paving of closely-compressed and tesselated cells. Layer after layer of this tissue follow each other, one above the other, until the whole space of the wound is completely filled up. The progress of the minute primary vessels, also affords an exceedingly interesting study of the origin of vascular tissue;—whether simple branched or anastomosing, not only in animals of a low degree of organization, but also in the higher warm-blooded animals; as he had also observed similar appearances amid the cartilaginous fibres in a portion of the prepared fœtal skull of an infant, and also in the somewhat similar cartilaginous structure of bone in a case of mollities osseum, described by Mr. S. Solly at St. Thomas' Hospital. The remaining part of the paper was devoted to a minute description of the appearance of this primary vascular tissue, in various stages of its developement in the periostracum of the shell.

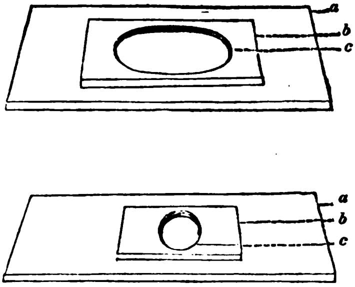
Microscopical Intelligence, &c.

HINTS TO MICROSCOPISTS,

[*Describing the manner of making cells and glass-boxes in which to keep objects for microscopic examination, and for arrangement in museums; the fluids used in preserving, and the manner of suspending them in these cells and boxes; together with a plan of a box for containing, in a small compass, all the appliances necessary for such manipulations.*]

THE next form of cell which we shall describe, is that first suggested and used by Mr. Goadby of the Royal College of Surgeons. It consists of *three* pieces of glass, two (viz., the lower and middle) being of plate glass of various thicknesses and sizes, and the third or upper of the thin glass before spoken of. The middle piece of glass, which, for reasons to be hereafter stated, must have an oval or round hole, according to the form of the object to be preserved, in its centre. This central piece (figs. 1 and 2, *b*) is to be cemented to the lower plate of the cell (figs. 1 and 2, *a*), which should always be of plate glass, on account of its possessing a perfectly plane surface,* and moreover from its being free from any irregularities of surface, in both of which properties crown glass is wanting. The best cement for this purpose is *Jeffery's Patent Marine Glue*† of the softer kind, viz., that which liquifies at a temperature of about 300° Fahr. The harder kind requires a temperature of 500° to liquify, and is therefore totally inapplicable to microscopical purposes.

The process for cementing the cell is as follows:—First cut into shavings a portion of the glue and lay them on the sides of the middle or perforated piece of glass (figs. 1 and 2, *b*), as near as possible to the hole, then put it upon a wrought-iron plate, heated to a sufficient temperature to melt the cement, and also the under portion of the cell (figs. 1 and 2, *a*), for the purpose of warming it, in order that it may the better receive and unite to the liquified cement, when the middle or perforated plate is laid and pressed upon it. When perfectly melted, lay this plate upon the under one, and while in the act of cooling, which should be prolonged as much as possible, the operator should move about the middle upon the under plate of the intended cell, at the same time using strong pressure. This renders the layer of cementing material very thin, which, like other cements, holds the parts together much more firmly than a thicker layer. It has another great advantage, by its increasing the transparency, and thus enabling a greater portion of light to traverse it. This is of the highest importance in examining opaque objects, especially large ones, for by it a greater number of rays of light is reflected by the Lieberkuhn, upon the object to be examined.



Figs. 1 and 2.

Having cemented, in the manner above described, the middle or perforated piece of plate glass to the under plate, the well so constructed should be immediately cleared of all superfluous glue, by first scraping it off with a knife (care being taken not to scratch the glass), and afterwards wiping those parts of the glass on which it had been deposited, with a linen rag saturated with spirit of wine. We recommend this process to be done as soon as the glue is set, and while the glass is yet warm, because, if delayed for a longer period, this process is rendered more difficult. The well, after being cleaned, may be used immediately; but, as all the appliances for making the cells are at hand, it saves much time and labour to make several of them at one time of different sizes and thicknesses, and with the central perforations of the middle plates of circular and ovoidal forms; the observer will thus have always at hand wells adapted for any preparation which he may wish to *put up*. The object intended to be preserved, having been placed in this well, the upper slip of thin glass should be put upon it, and cemented at the edges with the cements, and in the manner recommended in the case of simple cells in the October number of this Journal. If the preparation requires to be preserved in a moist state, great care should be taken to exclude all air-bubbles from the cell while putting on the slip of thin glass, and the cell should then be laid aside to allow the fluid, which is drawn between the surfaces of the upper slip and the middle or perforated plate by capillary attraction, to evaporate, so as to leave the junction of the outer edge of thin glass with the surface of the middle plate tolerably dry, in order that the gold size and lamp-black, or sealing-wax cement, may the more closely adhere to this part.*

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* Plate glass of different sizes and thicknesss, drilled in this way, can be obtained of Mr. Dennis, Mount Pleasant, Clerkenwell; Messrs. Powell and Lealand; and of Mr. Topping.

† The patent marine glue may be obtained at a cheap rate of Jeffery & Co., Commercial Road, Limehouse.

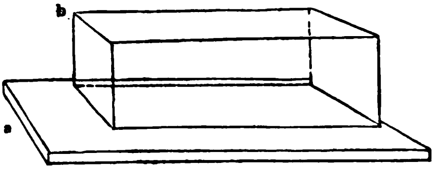

Fig. 3.

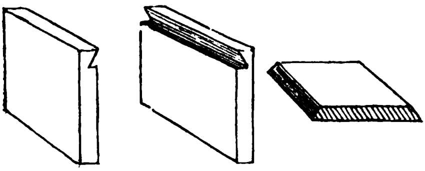

Fig. 4.

The next vessel to be described for preserving preparations best adapted for arrangement in a museum, and for examination from time to time, is one also suggested, and first brought into use by that excellent practical anatomist and microscopical manipulator, Mr. Goadby, through whose kindness the information detailed in the description of this and the preceding cells is almost wholly due. It is a glass box, forming a parallelogram (Fig. 3), and consisting of four plates (*b*), of plate glass, cemented by the *marine glue* or *gold size* and *lamp-black cement*, to an under plate of plate glass (*a*), and also at their several parts of contact. When the object or preparation has been put into this *well*, it is to be covered by the *thin* glass before alluded to, or thin or thick *crown* glass according to the size of the box required for the preparation, and the magnifying power necessary, in order that the preparation may be brought within the focal distance of the object-glass. These boxes may be made of any size, to suit large or small preparations, the thickness of the glass of which they are constructed, always being proportioned to the size of the box. It is necessary to observe, that when the *gold size* and *lamp-black cement* is used, it is necessary to indent or notch the points of contact of the side plates with the end plates, and to bevel off the latter so as to fit this notch (as depicted in the section Fig. 4); for as this cement takes some time in drying, and, even when it has become hard, is liable to soften in a warm room, or when exposed to a rather high temperature, the weight of the fluid and preparation within, or any pressure from without, will often separate the joints, and the contents therefore escape, and perhaps be injured. The above process will always prevent this; but, if the marine glue be the cementing material, this process is unnecessary. Another ingenious contrivance has also been suggested by the same indefatigable anatomist:—It is often necessary, for the perfect examination of a contained preparation, that every part of it should be brought within the reach of the focus of the object-glass, and the under plate of the boxes would, in the majority of cases, prevent our examining its sides; yet the projection of this under plate is necessary for packing it in a box, in order to make it portable. The contrivance consists simply in making the under plate of the box flush with its sides, and to project at the ends from $\frac{1}{10}$th to $\frac{1}{4}$th of an inch, according to the size of the box required; these projecting ends to be bevelled off (Fig. 5), so as to fit similar bevelled surfaces, but cemented by their plane surfaces, in an inverse or opposite direction, to a much larger plate of glass, so that the box shall glide in, and in this way be adapted for packing in a microscopic preparation case. As it is often difficult to clean glass used for mounting objects, and unless the surfaces of the glass be clean, air-bubbles are sure to be enclosed in the simple cells, it may not be out of place here to describe the process by which glass may be readily and effectually cleaned from all adhering matters, greasy or otherwise.

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* The mode of suspending preparations in these cells, or glass boxes, will be described in a future number.

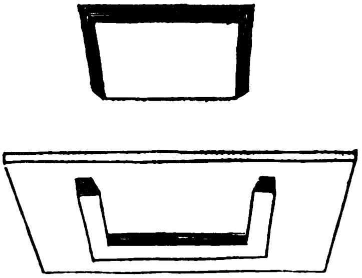


Fig. 5.

The best process (and it is certain to effect it) which Mr. Goadby has found for this indispensable object is to first apply, by means of a pointed stick, some *oil of vitriol*, with which the surfaces should be well rubbed; and immediately after the vitriol has been well applied, then use, in a similar way, caustic potash, and afterwards well rinse the glass in water, and wipe it dry by means of a fine cloth, taking care to prevent the contact of the fingers with any portion of its surfaces. To prevent this, the rinsing should always be effected by holding the glass with a forceps.

ROSS'S IMPROVED ACHROMATIC COMPOUND AND SIMPLE MICROSCOPE.

PREVIOUS to the improvements which have recently been made, the Compound Microscope was but a comparatively feeble and inefficient instrument, and was considered useless for the purposes of investigation. This was owing to the distance the light had to traverse after refraction, through the uncorrected object-glasses, and the consequent increased dispersion producing only confused vision. This error was diminished to the utmost possible extent by limiting the aperture of the object-glasses, and thus restricting the angle of the pencil of light from each point of the object, while the enlargement of the aperture is the real improvement in the optical part of the instrument. Even after the improvement of the simple microscope, by the use of doublets and triplets, the long course of the rays, and the large angular pencil required in the compound instrument, deterred the most sanguine from anticipating the period, when they should be conducted through such a path as to be free from both chromatic and spherical error; and the general opinion was, that the compound would never rival the simple microscope. Nor is this opinion to be wondered at, when we consider the increase of difficulty attending every enlargement of the pencil, and that these difficulties had to be contended with and removed by operations on portions of glass, so small that they are themselves almost microscopic objects.

Fortunately for science, and especially for the departments of animal and vegetable physiology, these opinions have been shown to be unfounded, and the compound microscope is now one of the most important instruments ever bestowed by art upon the investigator of Nature; it reveals to us the beauties of form and colour in the minute works of Creation, which leads to such instructive pursuits, that the microscope must become an educational instrument. To these claims on our attention, it appears from some observations in the introductory paper of this Journal that others of high importance are added, namely, the classification of genera, and the examination of human organic matter, affording evidence regarding the nature and seat of disease.

I have thus noticed the claims of the achromatic microscope in its improved state, previous to entering on a description of the mechanical and optical parts of the instrument.

The mechanical construction represented in Plate 4, is derived from a practical acquaintance with the various improvements made in the microscope for the last twelve years. The general arrangement, which is properly the province of the mechanic, has been contrived to obtain the utmost freedom from tremor, and to afford the greatest facility in using the various movements, while the extent, direction, and number of these have been collected from the experience of the most indefatigable observers in all the various branches of microscopic inquiry. Nearly one hundred instruments have been made on the plan here represented, and as no alteration or addition has been found necessary for the accomplishment of all the modes of microscopic investigation at present employed, the mechanical structure of the microscope stand may be considered thus far established.

The optical part also has arrived at such perfection, that points or lines, whose distance is such that their separation is bordering on interfering with the physical constitution of light, can be distinctly separated; thus ensuring a reality in the appearance of objects, where the minuteness of their detail approaches the natural limit of microscopic vision.

Description of the Instrument, (Plates 4 and 5.)

A A are two uprights, strengthened by internal buttresses, mounted on a strong tripod (B), at the upper part, and between the uprights is an axis

(C), upon which the whole of the upper part of the instrument turns, so as to enable it to take a horizontal or vertical position, or any intermediate inclination, such, for instance, as that shown in the plate. This moveable part is fixed to the axis near its centre of gravity, and consists of the stage (D D), the triangular bar and its socket (E and F), the arm (G), which carries the microscope tube (H), and the mirror (I). The stage (D D) has rectangular movements, one inch in extent, on the racked cylinders (*a a*), and are moved by pinions connected with the milled heads (*b b'*); it also has the usual appendages of forceps to hold minute objects, and lens to condense the light upon them. The triangular bar, together with the arm and microscope tube, is moved by the milled heads (*e e*), and a more delicate adjustment of this optical part is affected by the milled head (*f*). The other milled head (*g*) fixes the arm (G) to the triangular bar.

The outline of the structure, as before observed, has been arranged to obtain, first, the utmost freedom from tremor; and, secondly, to afford the greatest facility in using the various movements.

In experimenting to obtain the first of these conditions, I suspended the moveable part of the instrument near the centre of gravity, and employed the inverted pendulum (an instrument contrived to indicate otherwise insensible vibrations) to arrange the form and quantity of material, so as to produce, as nearly as possible, an equality of vibration throughout the whole instrument; hence the object upon the stage and the optical part vibrating equally, no visible vibration is caused. The arrangement for accomplishing the second condition is, first, that the whole movements should be as near the base of the instrument as is consistent with the greatest proximity among themselves; then the milled heads (*e* and *f*) for moving the triangular bar, and the fine adjustment for the optical part, should be moved by the left hand, while the heads (*b b'*) for the movement of the stage, should be worked by the right hand. The other milled head (*e*) is convenient when the right hand may be unemployed with the stage movements. The positions of the milled heads (*b b'*) are extremely convenient, as the middle finger may be placed under *b*, and the fore-finger under *b'*, and the thumb passed from the one to the other in the most natural and easy manner. The left hand is also readily shifted from the milled head (*e*) to employ the fore or middle finger to move the screw head *f*. This head is connected with a screw and lever, which makes one revolution of it move the optical part $\frac{1}{300}$th of an inch. This arrangement affords an elastic movement to the end of the tube, as a guard against injuring the glasses or the object under examination.

The accompanying apparatus to the microscope is represented in Plate 5, where 1, 2, and 3, are the eye-glasses; 4, a micrometer eye-glass for measuring the linear dimensions of objects; 5, a Wollaston's camera-lucida for drawing objects which are placed in the microscope, with lenses for making the pencil equally visible with the object seen in the prism; 6, a concave silver reflector for illuminating opaque objects, (this I arranged as a general illuminator, and may be used with the whole range of object-glasses). 7, The achromatic Wollaston condenser, first achromatized by Dujardin for illuminating transparent objects, in which the light is brought to focal points in a plane coincident with the object; hence no inflexion or diffraction occurs, and the outline or detail of the object is represented nearly divested of penumbra; 8, represents a plate and tube holding a polarizing prism to be applied under the object, while an analyzing prism is placed behind the object-glass or above the eye-glass. Structures are ascertained when viewed in this apparatus, which cannot otherwise be detected; 9, forceps for holding objects; 10, a lens for condensing light, in conjunction with the large lens represented in Plate 5; 11 and 12, Varley's animalcula cages; 13, an adjustable compressor, designed by Mr. Lister; 14, a plate for fixing a frog, fish, &c. upon, for viewing the circulation of the blood; 15, an arm for holding single lenses, to be applied to the microscope when the arm (G) carrying the optical tube is removed.

The optical part of the microscope has been in a state of progressive improvement since the year 1820, during which time Selligne, Frauenhofer, Amici, and Chevalier on the continent, and the late Mr. Tully of London, succeeded to a certain extent in their attempts to construct achromatic object-glasses for the microscope; and about the year 1829, Mr. J. J. Lister discovered certain properties in achromatic combinations, which proved of such value to the practical optician, that the progress of improvement was in consequence greatly facilitated, and a gradual increase in the aperture of object-glasses (which, as before observed, is the chief improvement) took place; and I have recently succeeded in transmitting into the pupil of the eye a pencil of light from the object of 90° in angular extent.

The following is a table of my achromatic object-glasses, with their angular apertures, and the magnifying power at which the greatest separating effect is produced:—

Focal length of object-glass.	*Angular aperture.*	*Greatest separating magnifying power.*
2 inch	10°	80 diameters.
1 ,,	22°	180 ,,
$\frac{1}{2}$,,	44°	380 ,,
$\frac{1}{4}$,,	60°	500 ,,
$\frac{1}{6}$,,	66°	550 ,,
$\frac{1}{8}$,,	70°	570 ,,
$\frac{1}{12}$,,	90°	700 ,,

MR. VARLEY'S DESCRIPTION OF HIS NEW LEVER MOVEMENT,

(For facilitating the Examination of Infusoria and other Animalcula, while under the Microscope, and avoiding the inconveniences attending all former Stage Movements for such examination.)

FINDING that the movement of the stage by *screws*, or of the object by the hand, would not enable me to follow with sufficient government or controul the active motions of many animalcules, and so keeping them within view for a length of time sufficient for observing their habits, structure, and mode of reproduction, I determined on applying levers for the purpose of moving the stage. The first stage which I constructed with this view, was that which was moved by two parallel levers, one at each side, hanging down, and connected at the bottom by a bar parallel with the stage; on moving this bar the two levers were necessarily moved at the same time, and the stage was, therefore, moved

lel in any direction. This arrangement effected the desired pur-
and was the cheapest and simplest mode of doing it; but the two
s and cross-bar interfered with the means of lighting from under
tage, and more particularly with the direct light from any illumina-
body. To remedy this evil I contrived a mode of moving the
in any direction, at the same time preserving its parallelism by
is of a *single* lever, placed so much aside as not to interfere with the
of light, thus leaving the stage and space under it sufficiently clear
he reception of any of those contrivances for rendering the light
matic, which are now so generally in use.

ie present microscope is the third variety of single lever stage move-
s I have made. In this the moving stage-plate slides easily on the
plate in any direction, strictly parallel, and with the same degree
ction. The lever hangs down near to the table, so that one arm
ig on the table can move the stage in all directions, and thus keep
living object under examination in view for an indefinite period,
it the other hand can be employed in keeping it in focus.

ie considerable advantage of the lever movement is, that the hand
, involuntary as it were, the object in any direction, and a beginner
hus use this stage without difficulty.

gs. 1 and
w a front
side view
he stage,
the parts
tly sepa-
l in order
ow them.
e will ex-
how the
on is ef-
d :—*a* is
ed-plate;
ocket ful-
connect-
th it; *c c*,
moveable
, to slide
it having
s (*d d*) to
it close
ı; *e*, an arm jointed to *c*, and with a socket (*f*) to the lever (*g*);
all at *b* is the stationary fulcrum, so that on moving the lower end
f the lever sideways, its upper ball (*f*) will, by the jointed arm (*e*),
the stage in a contrary direction, and as the microscope also re-
s the object, this motion agrees and becomes a direct one. The
lelism of the motion in all directions is secured by a stiff swing (*i i*),
h is jointed at each end to the upper plate at *c c*; whilst its lower
i i) is connected to the under plate (*a*) by two parallel rods (*j j*) with
and socket joints. This connection holds the plates together
ly parallel, yet with freedom to slide in any direction with a similar

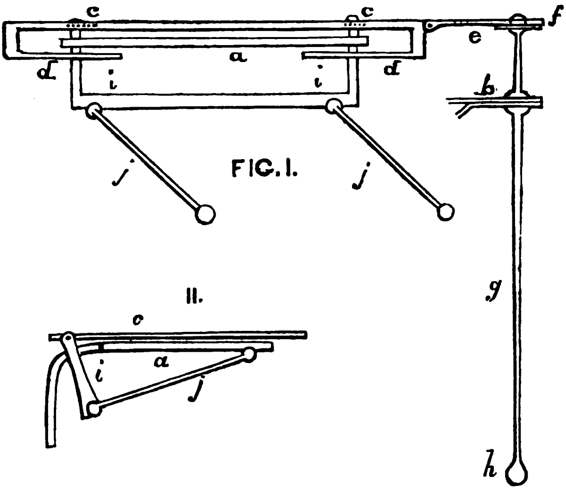


FIG. I.

II.

degree of friction. The end (*h*) of the lever is heavy enough to balance the weight of the stage when it is in an inclined position.

A second feature in this microscope, is the attaching a phial-holder in a vertical position, so that a phial may be held in its usual position, and turned round to examine any living objects within it, which may adhere to the inner surface, without shaking them off, any horizontal inclination of the phial always having this tendency.

A third feature is connecting the body to the stage by a long plain sliding rod, which can be clamped at any height, to allow of large objects being laid on the stage to examine their surface.

Fourthly, my graphic telescope, for drawing objects of all sizes less than life, up to a few times larger than life, can have its body fitted to the sliding rod, to be a graphic microscope, whereby objects may be traced as much larger as I please to magnify them.

Thus an instrument is offered, which I think the most facile for examining living objects, by its enabling us to keep them in view, and follow them through all their evolutions; and the most complete in its extent for drawing magnified objects, without the least abatement of its fitness for examining inanimate objects.

CAUSE OF THE "SMOKY" APPEARANCE OF WINDOWS OF THE METROPOLIS.

When windows are suffered to remain a few weeks at this season without being cleaned, they are observed to put on a "smoky" appearance, becoming more or less blue on account of the whitish matters deposited upon them. If this deposit be allowed to remain for some considerable time, it will then become spotted with whitish semi-opaque patches, which distinct at first, but gradually coalesce.

If these spots be now examined with a lens, they will be found to be composed of *crystals*, assuming beautiful arborescent forms. When the windows are examined when first becoming "dirty," the coating then is seen to be formed of crystals, exceedingly minute, but having no arrangement.

After many alternations of damp and dry days, these crystalline matters become dissolved and re-crystallized many times, and are re-inforced by successive additions to them from the same source, when ultimately they assume the arborescent arrangement above referred to.

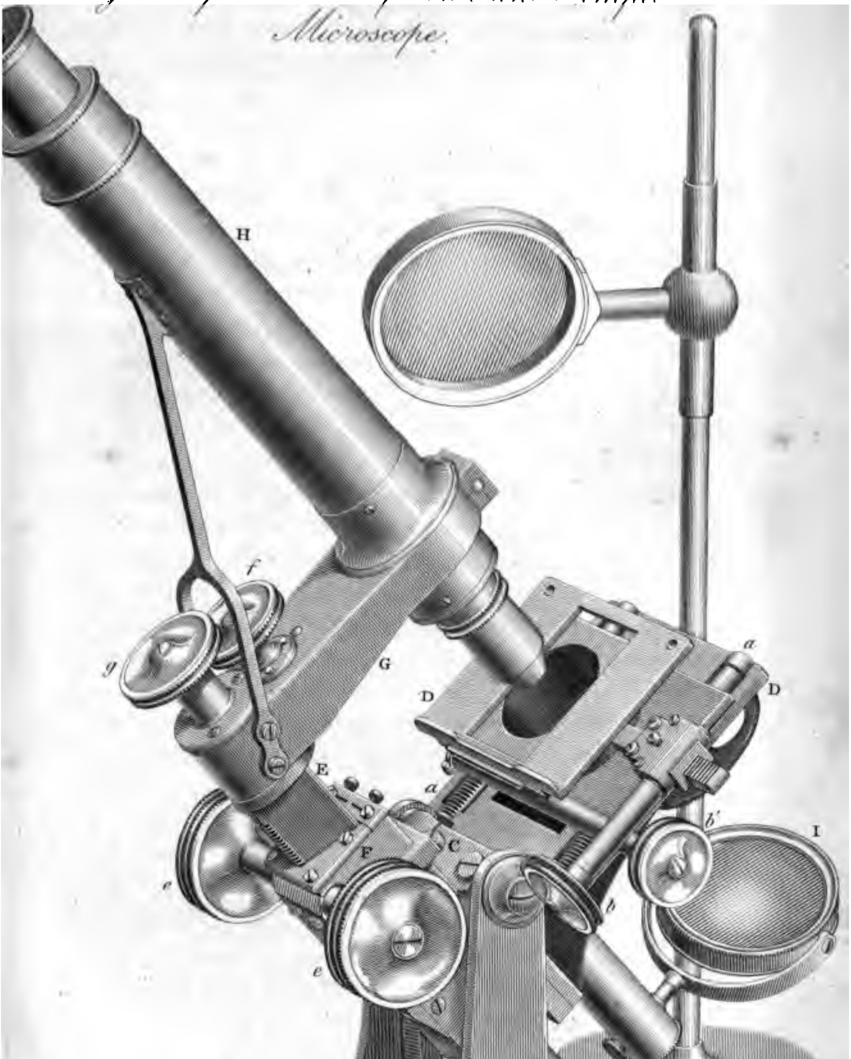
No doubt but these deposits are from fuliginous matters sent into the air from the numberless fires that are continually pouring forth their smoke to deteriorate the atmosphere; and when it is considered the thousands of tons of coals consumed in London daily, one-eighth part of which are lodged in the atmosphere, we have a plentiful supply of the gaseous constituents of such bodies.

It is conceived, that as sulphurous and sulphuric acids are known to exist in the atmosphere of this city together with ammonia, which is common to even pure air, that the crystalline matter on the windows is formed of these bodies, and deposited by degress, so as to effect the transparency of the glass. These crystals are not confined to windows, but may be found on glass, and probably other bodies, when not exposed to the light.

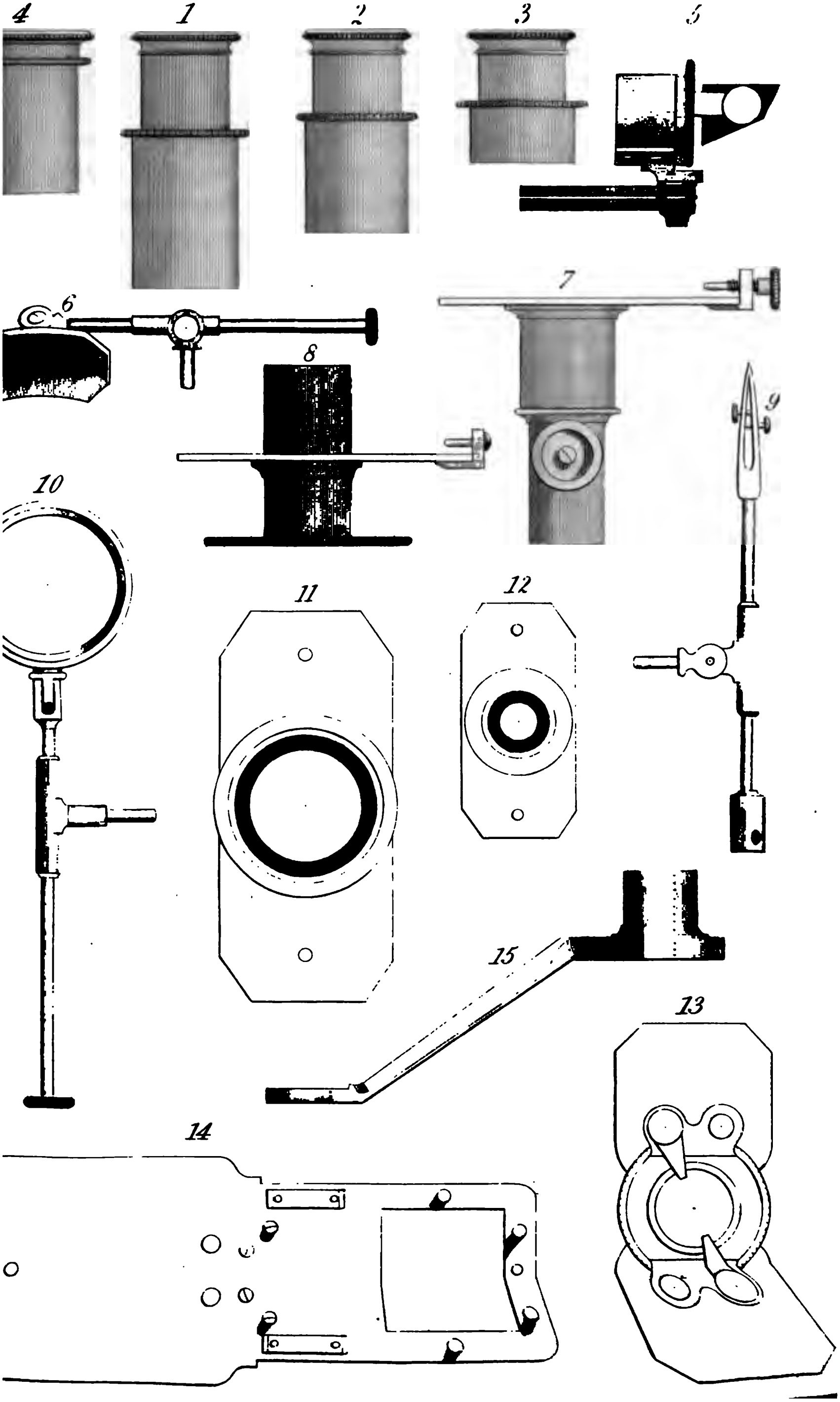
E. J. Quekett.

London Physiological Journal. Pla.

Ross's improved Compound and Simple Microscope.



London Physiological Journal. Plate 5.



SOME REMARKS ON THE INTERNAL STRUCTURE OF VOLUNTARY MUSCLE.

By S. J. Goodfellow, M.D., &c.

THE following remarks upon the intimate structure of voluntary muscle were principally suggested from an examination of a most beautiful preparation of the muscular fibre of a pig, by Mr. Lealand, the partner of Mr. Powell, the eminent optician, and by him was my attention first directed to the transverse dark lines seen in fig. 5, *d* (Plate VI.)*

The tendency of these remarks will be to prove that the terms fasciculi, and fibrillæ, first applied by Fontana, are the most correct, and in every respect agreeable with the structure of the muscular tissue; and, moreover, that the longitudinal cleavage is the natural one, and does not necessarily involve the rupture of the intrinsic components of the tissue, viz., the tubular transparent covering and its contents.

But, as many of the readers of this Journal may not be aware of the different opinions held upon this subject by past and present anatomists, I shall premise the few observations which I have to make by a short summary of these various opinions, and in doing this I shall make free with the excellent account given by Mr. Bowman in his article, "*Muscle and Muscular Action*," in the Cyclopœdia of Anatomy and Physiology.

The ancients appear to have been quite ignorant of the nature of muscles. Plato and Aristotle regarded them, like fat, as a kind of clothing which kept out heat in summer, and cold in winter.† The nerves and tendons were confounded with the muscles, as they commonly are at this day by the vulgar. Even at a period so near to our own as 1734, the date of the appearance of Borelli's elaborate work, "De Motu Animalium,"* that author thought it necessary to adduce arguments against the doctrine, commonly entertained at that time, that muscle and flesh are different—the former being composed of an aggregation of tendinous fibres, the latter of a certain villous substance encrusted by the blood; which doctrine clearly shows that the notions that prevailed on this subject were extremely loose up to within a comparatively recent period. Numerous have been the speculations on the structure of muscular fibre, as upon that of all other tissues; but it was not until *man's second optical sense* began to be appreciated, that any definite or correct ideas were entertained upon this subject. From Robert Hooke's description it would appear probable that he had a tolerably correct general knowledge of the elementary fibre of voluntary muscle, since we find him in 1678 speaking of the "fibres which seemed like a necklace of pearls in the microscope."† That indefatigable and enthusiastic observer, Leeuwenhoek,‡ the friend and correspondent of Hooke, supposed that each elementary fibre was a perfect and separate organ in itself. He alludes to the cross lines on this elementary fibre, which he conceived to occupy the surface only, and to be due to the coils of a spiral thread. He further saw the longitudinal lines visible on the elementary fibre, and considered them to be an evidence of a still minuter composition by fibrillæ. Contemporary with Leeuwenhoek was De Heide,§ who also described and figured the cross markings of voluntary muscle. Malpighi‖ also observed the transverse stripes. Prochaska,¶ in 1778, well described the figure, size, and solidity of the elementary fibre, and the appearance of the *fibrillæ into which it divides*; but in consequence of his confounding the transverse markings in the intervals of the discs with the creasings and flexuosities, which are the result of mechanical causes, he attributed them to the lateral pressure made on the fibre and fibrillæ by vessels, nerves, and areolar tissue. Fontana,[*] who, if not always accurate, is never far from being so, has stated the elementary fibre *to consist of fibrillæ, each of which is a series of particles; and he imagined that the transverse lines are caused by the regular apposition side by side of the particles of the contiguous fibrillæ.* Hence he termed the fibre a *primitive fasciculus.* From Fontana's time up to within the last few years this subject appears to have taken a retrograde course, for, according to Sir Everard Home and Mr. Bauer, no transverse striæ could be observed, which must have been owing in the case of the latter to the imperfection of his object-glasses; for it is difficult to conceive that so excellent an observer could have failed to detect them had this not been the case. They[†] regarded the ultimate fibre as consisting of a string of globules of the blood (!), estimated by Capt. Kater at the diameter of about $\frac{1}{5000}$th of an inch. This opinion, notwithstanding its palpable absurdity, was said to be confirmed, according to Dutrochet, by Beclard, Edwards, Prevost and Dumas, and by himself, and was first opposed by Dr. Hodgkin and Mr. Lister, who *re-discovered* the transverse markings on the elementary fibre of voluntary muscle, and of the heart, and pointed out, as Muys and Fontana had done, that their presence was a character by which the fibres of voluntary muscle, or that of animal life, could be distinguished from those of involuntary or muscles of organic life, as the uterus, alimentary tube, bladder, &c. Lauth, Müller, Schwaan, and Henle, agree pretty nearly with Fontana.

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* Fig. 5.—A. Muscular fibre, magnified 350 times linear.

B. Natural size—*a*, Primitive fasciculus; *b*, portions of fasciculi detached in certain parts from the main portions, to which they are still adherent at their extremities; *c*, single fibrilla.

E. Fibrilla magnified 750 times linear.

D. Same fibrilla hypothetically reduced longitudinally one half, and extended therefore transversely to an equal extent—*d*, transverse line between discs; *e*, the circular discs, contained within their investing membrane, or sarcolemma, *f*.

† Vesalius, vol. 1, p. 182.

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* Proposition ii.

† Posthumous Works, by Waller. 1707. Life, p. 20.

‡ Epist. Physiologicæ.

§ Experimenta circa sanguinis missionem, fibras motricas, &c. Amst. 1698.

‖ De Bombyce. Pp. 9 and 10. Written before 1697.

¶ De carne musculari. Viennæ, 1778.

Mandl[‡] conceives the cross markings to be produced by a spiral thread of areolar tissue investing the fibre, and Dr. Barry[§] regards the fibril as a peculiar form of his grooved and compound filament, each being composed of two spiral threads wound in opposite directions, and interlacing. But this appearance of the spiral form of the fibrillæ is evidently and palpably the result of manipulation, and can always be obliterated by further manipulation, and the markings on the fibrillæ, and on the fasciculus, be brought perfectly transverse. The spiral appearance is entirely owing to a slight twisting of the fasciculus, while preparing it for examination; it is purely accidental, and, in every case, constitutes the exception and not the rule. Mr. Skey[*] deduces from his observations that the muscular fibres (*primitive fasciculi* of Fontana and others) are surrounded by circular striæ, which are actual ridges or elevations on the fibre, leaving depressions between them, and that each fibre is divisable into bands or fibrillæ, which, composed of many ultimate filaments, are arranged in parallel longitudinal lines around the axis of the fibre, and that each band or fibrilla is subdivided into filaments, of which every fibre of $\frac{1}{400}$th of an inch in diameter contains about 100. The filaments, according to this anatomist, possess a diameter of about $\frac{1}{16000}$th of an inch—are tubular, and arranged longitudinally around the tube of the fibre, which finally contains a soluble gluten.

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[*] Sur le venin de la Vipere. 1781.

[†] Philos. Trans. 1818—26.

[‡] Traité pratique du Microscope, p. 74-5. Paris. 1839.

[§] hilos. Trans., 1841-42 .

Lastly, Mr. Bowman[†] considers that the *primitive fasciculi* "consist of elongated polygonal masses of *primitive* component *particles* or *sarcous elements,* arranged and united together edgeways and sideways, so as to constitute in these directions respectively fibrillæ and discs, either of which may, in certain cases, be detached as such, and both of which, in the unmutilated organ, always exist together." These fibrillæ, according to the same excellent observer, as well as Dr. Todd,[‡] cannot be obtained from the *primitive fasciculus* or *elementary fibre,* unless by a fracture. "They do not exist as such in the fibre, and it occasionally happens that no disposition whatever is shown to this longitudinal cleavage; but that, on the contrary, violence causes a separation along the transverse dark lines. By such a cleavage discs, and not fibrillæ, are obtained; and this cleavage is just as *natural,* though less frequent than the former."

Now from the view which I take of the structure of the *primitive fasciculus,* this *transverse cleavage* is always attended with a tearing of the sarcolemma and a separation of the *primitive discs* (sarcous elements or primitive particles of Mr. Bowman) contained in it; while, on the contrary, a longitudinal cleavage may be effected without any rupture or separation of their intrinsic components of muscular tissue, but merely a separation of the fibrillæ themselves.

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[*] Philos. Trans., 1837.

[†] Philos, Trans. 1840-1.

[‡] Physiological Anatomy and Physiology of Man, Part I.

On examining the preparation, of which the figure A is a copy, with one of the Messrs. Powell and Lealand's latest quarter of an inch object-glasses, I was much struck with the number and length of the longitudinal cleavages, the different sizes of portions of the primitive fasciculi, and the exact rectilinear, and therefore rectangular form of the primitive discs and the interspaces between them. On looking at it with a magnifying power of 750 linear, at the suggestion of Mr. Lealand (who first directed my attention to them), dark transverse lines were distinctly visible between the discs, not only in those portions of fasciculi in which there were two or more of the fibrillæ in apposition (*b*), but also in the single fibrilla (*c*), in which they were equally, if not more distinct. I conclude the diagonal cord (*c*) to be a primitive fibrilla, for on a constant examination of several hours' duration I could detect no longitudinal dark line in the centre, as can be readily seen where two or more fibrillæ are in contact with each other, nor any indication indeed of any further *natural* division. In this fibrilla three different parts were plainly seen: first, the rectangular primitive discs; secondly, the transverse lines between them; and thirdly, a layer of homogeneous transparent membrane (sarcolemma) on each side, with which the transverse dark lines were in contact. Now to what peculiar arrangement of structure are these dark lines due? Are they due to an accidental depression or elevation of the investing membrane between the discs; or, are they due to an indentation of the sarcolemma at this point, from which a process proceeds transversely across the tube, and between the discs? The latter, after repeated examination, I conclude to be the case. On examining well the external homogeneous layer at the sides, it appeared to have a scalloped shape in some parts, the contracted parts corresponding with the apparent attachment of the transverse lines in every instance, while the portions which were swelled into equal sized segments of circles corresponded with the situation of the contained *primitive discs* (sarcous elements or primitive particles of Mr. Bowman). I first suspected this scallop-shaped appearance to be owing to the refraction of light occasioned by the discs, which are highly refractive, and am still inclined to attribute some part of this appearance to refraction; but, from arranging the light in different ways, and examining the preparation by day as well as by lamp-light, and avoiding all appearance of refraction I still invariably detected the indentations of what appeared to be the investing membrane, at the points of contact with the transverse dark lines. From these appearances I think it not improbable that these transverse lines are due to processes of the investing membrane stretching across the fibril, forming partitions between, and a separate space for each disc. From this view it would appear, that each fibril is composed of an external investing tubular membrane or *sarcolemma*, from which processes extend transversely across the cylinder of the fibril, forming chambers or spaces for certain particles, which Mr. Bowman has denominated primitive particles or sarcous elements, but which I think would be more properly termed *primitive* or *sarcous discs*. These bodies are perfectly rectangular, and when in their natural condition (D) have the same diameter between the opposite surfaces; but when elongated, by being extended from one portion of the fasciculus to the other (as in E), they, as well as the entire fibril, become narrower in the transverse diameter. No trace of any remains of any connecting medium between the contiguous fibrillæ could be detected. According to the admeasurement of Mr. Lealand, the diameter of the single fibrilla (*c*) is the $\frac{1}{20000}$th of an inch, which, supposing that it had been elongated during the manipulation, and, as it now appears in the preparation, to twice the diameter longitudinally than transversely, the diameter of the fibrilla, in its natural condition, would be about the $\frac{1}{10000}$th of an inch. If the above view of the structure of muscle be correct, each *primitive fasciculus* may be said to be made up of a number of fibrillæ, running together in a general longitudinal direction, united together, most probably, by a very fine areolar tissue, and the whole invested in a peculiar homogeneous membrane or sarcolemma. Each of these fibrillæ is again composed, as before stated, of an external tubular membrane, in which is contained rectangular bodies or discs, which are enclosed in chambers or spaces, formed by processes of the external investing membrane extending across the tube. The fasciculi are again united in bundles by areolar tissue of a coarser kind, forming the coarse fibres of descriptive anatomy. That there is a greater tendency in muscular fasciculi to split in a longitudinal direction, I think nearly every one has observed, and, contrary to the opinion of Mr. Bowman, I feel inclined to regard the longitudinal cleavage as a *natural* one, and one which may be effected without any rupture of the intrinsic components of the fibrillæ, viz., the sarcolemma, discs, or transverse partitions.

In concluding these few remarks, I feel it necessary to state that they are the result of examinations of preparations of muscular fibre taken from one animal only, and are thrown out more as suggestions for confirmation or otherwise, by any one who may have more time to devote to this very interesting inquiry, than as settled convictions. My only object is the furtherance of truth, and if the opinions advanced in the foregoing remarks shall be proved to be erroneous, I shall feel a pleasure even in renouncing and abandoning them as publicly as I thus state them.

ON THE MICROSCOPIC STRUCTURE OF THE TEETH OF THE LEPIDOSTEI, AND THEIR ANALOGIES WITH THOSE OF THE LABYRINTHODONTS.*

By Jeffries Wyman, M.D. (Boston, U. S.)

THE Lepidostei, like other Sauroid fishes, are provided with large conical teeth, intermixed with more numerous teeth of a smaller size. The larger teeth are found on the upper and lower maxillaries, and the intermaxillaries; the smaller ones are found on the same bones, and also on the vomer and palatines. On the last two they are arranged "en carde," except on the anterior portion of the vomer in the *Lepidosteus oxyurus*, where they are arranged in a linear series. The larger teeth, of which the microscopic structure is here more particularly described, are a little recurved, have a conical form, and sharp and slightly trenchant points; externally the surface is smooth near the apex, but more or less striated or fluted near the basal portion.

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* Communicated by the Author.

The base is implanted in a cavity or alveolus, with which it is anchylosed; but from which, when shed, the teeth are detached by the absorption of their substance at the points of union.

The teeth of the *Lepidosteus platyrhinus*, Raf., and *L. oxyurus*, Raf., when cut at right angles to their axes, present a surface which is subdivided into numerous segments, by lines extending from the circumference towards the centre, the whole resembling somewhat a section of a porcupine quill. Under the microscope this appearance is seen to be the result of a peculiarity of organization hitherto undescribed in the class of fishes, and to which there is an approximation in the teeth of the Ichthyosaurus, and a still closer resemblance in those of the Labyrinthodonts. With regard to the teeth of the *Lepidosteus ferox*, Raf., I am unable to give any information, since as yet I have not been able to submit them to microscopic examination.

In the *Lepidosteus oxyurus*, where the teeth are the least complicated (though constructed upon the same plan as in the *L. platyrhinus*), the basal portion is fluted, while that near the apex is perfectly smooth, which differences correspond to others in the substance of the tooth still more striking. (See Plate VI, fig. 1, *f*.) Externally the tooth is covered with a layer of investing substance or "cæmentum," (figs. 1 and 2, *b*), which follows the outline of the more internal fluted portions; and within this is a second more transparent layer, (figs. 1 and 2, *c*), which at the space between two adjoining convolutions extends in a straight or but slightly curved line towards the centre (fig. 2, *d*), and being folded on itself, returns again towards the circumference; and this is repeated between all the different segments. The length of the involved portion is equal to a little more than one-third of the diameter of the tooth. The pulp cavity, which in the mature tooth is quite small, is characterized by the existence of radiations from its circumference towards the exterior of the tooth, terminating at equal distances from the centre, and occupying the middle of the spaces between the involutions of the cæmentum (figs. 1 and 2, *e*). The space comprised between the involutions of cæmentum and the radiations from the pulp cavity, is filled with "dentine," which is characterized by the existence of calcigerous tubes, of which there are highly magnified representations in fig. 2, *a*, and 3; these last in nearly all cases radiate from the prolongation of the pulp cavity, but very few of them coming from that cavity itself.

In the apical portion, which is perfectly smooth externally, the internal structure is much more simple than that of the basal portion which has just been described, there existing no involutions of cæmentum, and no radiations of the pulp cavity. The calcigerous tubes in the apex radiate at once from the central cavity, extending towards the circumference.

The teeth of the *Lepidosteus platyrhinus,* Raf., (fig. 4), commonly known as the "duck-bill gar," are constructed upon the same general plan, though more complex in the details. The involuted cæmentum extends in straight lines towards the centre for a very short distance only, and then becomes more or less irregular in its course, sometimes being undulated, and at others changing its direction suddenly so as to form angles (fig. 4, *b*). The pulp cavity and its prolongations are also more or less irregular, according to the condition of the cæmentum, generally terminating in a simple dilatation, or, as is sometimes the case, bifurcating, as at fig. 4, *a*. In the central portion of the tooth, exist also numerous pulp canals, which send off calcigerous tubes from their circumference, a conformation similar to that met with in the Rhizodus, among the extinct Sauroids.

Remarks.—In considering the structure of the teeth above described, no one can fail to recognise the analogy which exists between them and those of the Labyrinthodon, described by Prof. Owen in his Odontography; and had we nothing but the teeth of the respective animals to which they belong with which to institute comparisons, they would both be referred at once, without doubt, to one of the same natural family. Prof. Owen does not appear to have been aware of the existence of the Labyrinthodontic structure in the Lepidostei, since in speaking of the teeth of this genus no reference whatever is made to it, and in describing the involuted cæmentum of the Labyrinthodonts, he says, "such a disposition of the external substance may be traced at the base of the tooth in a few fishes, but is *more conspicuous* in the fang of the *Ichthyosaurus*."* If any one will make a comparison between the accompanying figure of the tooth of the *Lepidosteus oxyurus*, and that of the tooth of the *Ichthyosaurus* given by Prof. Owen in his Odontography, Pl. 64 B, fig. 3, it will be at once seen that in the former there is much closer resemblance to the Labyrinthodonts than in the latter; that is, in *Lepidosteus oxyurus* the involutions of the cæmentum are much more extensive—although the Ichthyosaurus is described by Prof. Owen as having teeth much more complicated in this respect than any existing animal.

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* Odontography, or a Treatise on the Comparative Anatomy of the Teeth, &c., by Richard Owen, F.R.S., &c. Vol. I, p. 201.

In comparing the teeth of the Lepidostei with those of the Labyrinthodonts, those of the former will be found much less complex than in a greater portion of the latter; though quite as much, and even more so, than in the *Labyrinthodon leptognathus*, figured in the Odontography, Pl. 63 B, fig. 1. Between the tooth of this last and that of the *Lepidosteus oxyurus*, there is no material difference, except in the size of the pulp cavity; the radiations of this last, and the involutions of the cæmentum having precisely the same relative position in both.

Thus we have the teeth of the Lepidostei, and some of the species of the Labyrinthodonts at least, reduced to the same type or plan of organization. In both the pulp cavity sends out its radiations, and in both the cæmentum is more or less prolonged inwards, at regular intervals subdividing the tooth into numerous sections. The calcigerous tubes in both cases are directed from the rays of the pulp cavity towards the investing cæmentum and its involutions.

The question very naturally presents itself, whether some of the fossil teeth from the Warwick sandstone in England, and the Keuper in Germany may not be referred to some extinct Sauroid fish, rather than the Labyrinthodonts, according to the views of Prof. Owen. The former existence of gigantic Batrachian reptiles it is presumed will not be doubted, since it is based upon osteological evidence which it is impossible to controvert. But Prof. Owen informs us, that in many instances the teeth from both the formations above mentioned, which were submitted to him for examination, were either mere fragments, or teeth detached from the jaws on which they grew. These he very naturally referred to the Labyrinthodonts, no such peculiarities of structure having been shown to exist in the other Vertebrata, excepting in a rudimentary form in the Ichthyosaurus, and the bases of the teeth of a few fishes. Since, however, the Lepidostei present peculiarities of structure, which vary only in degree from those of the Labyrinthodonts, the existence in a fossil tooth of the Labyrinthodontic structure alone, would seem to be an insufficient character for determining to which of the two natural families, Sauroid fishes. or Labyrinthodonts, it might belong. These remarks involve questions which we have no means at present of deciding, and would therefore submit them for the consideration of those favourably situated for instituting such comparisons as are necessary for arriving at a correct conclusion.

EXPLANATION OF THE PLATE.

Fig. 1, transverse section of the tooth of *Lepidosteus oxyurus*, Raf.; *a*, pulp cavity; *b* and *c*, cæmentum; *d*, dentine; *e*, radiations from the pulp cavity; *f*, tooth of natural size.

Fig. 2, highly magnified segment of preceding section; *a*, dentine, *b* and *c*, cæmentum; *d*, one of the involutions of the cæmentum, or pulp cavity.

Fig. 3, calcigerous tubes highly magnified.

Fig. 4, portion of transverse section of the tooth of the *Lepidosteus platyrhinus*, Raf.; *a*, one of the radiations from the pulp cavity, bifurcated at its termination; *b*, one of the processes from the cæmentum, having an undulated instead of a straight course, as in the Lepidosteus oxyurus; *c*, dentine; *d* and *d'*, tooth and transverse section of the natural size.

GENERAL RESULTS OF MICROSCOPIC INQUIRIES INTO THE MINUTE STRUCTURE OF THE SKELETONS OF MOLLUSCA, CRUSTACEA, AND ECHINODERMATA.

By William B. Carpenter, M.D.[*]

[With Two Plates.]

HAVING been engaged, during the last eighteen months, in microscopic researches into the skeletons or hard parts of animals, and having had my attention particularly directed towards the shells of Mollusca and Crustacea, and to the shells, spines, stems, &c., of the Echinodermata, I have been led to believe that a short *résumé* of the results at which I have arrived would be interesting and might prove of importance in giving a stimulus to further inquiry. Were it not, indeed, in the hope that the advance of science might be promoted by my bringing forward these results in their present form, I should have hesitated in doing so, until they had attained more completeness. I shall commence with the Mollusca, as presenting the greatest number of points of interest.

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[*] Read to the Geological Section of the British Association, August 1843, and communicated by the Author.

Mollusca.—The first point on which I desire to lay stress, is the complete distinctness of the organic basis of the shells of Mollusca from the calcareous portion. The two are not uniformly diffused through the shell, as some have supposed, but are separate elements, each having its own place. The organic or animal basis presents very definite characters, by which its nature may be determined, when the calcareous portion has been removed by the action of an acid.

I also think it desirable to state, *in limine,* that the structure of all shells appears to me to be equally *crystalline*; the carbonate of lime uniformly presenting a crystalline *arrangement,* if not a regular form. I cannot admit, therefore, the distinction between the *crystalline* and *concretionary* shells which Mr. Gray has attempted to establish; nor can I recognise the two forms of crystallization, the *rhomboidal* and *prismatic,* as characterizing different groups, for reasons which will appear in the course of this paper. The *crystalline aggregation* of the particles of calcareous matter in shell appears to me to be proved by the transparency of thin sections (except where patches of uncrystallized or chalky matter sometimes present themselves), and by their effects upon polarized light. It is very evident in some few instances, in which a distinct crystalline *form* is presented. One of the most remarkable of these is the tooth of *Mya arenaria,* a section of which presents the remarkable appearance shown in fig. 8 (Plate VIII), bearing a strong resemblance to that of Wavellite or radiating Arragonite. I have found distinct rhomboidal crystals in certain imperfectly calcified layers, which occasionally present themselves in *Ostrea edulis;* and similar crystalline deposits have been described as existing in the dense integument of some Ascidians.

The first distinction established by the microscope, between the different forms of shell structure, has reference to the nature of their organic basis. This, in most shells, consists but of a simple *membrane*, of extreme tenuity, and not presenting the slightest trace of *structure*, even when examined under the highest magnifying powers. This membrane is obviously analogous to the *basement membrane* lately described by Mr. Bowman ("Cyclopœdia of Anatomy and Physiology," art. *Mucous Membrane*) as existing between what is commonly termed the *true skin** and the overlying *epidermis*, and also between the ordinary mucous membrane and its epithelium; and I am inclined to believe that it originally holds the same position on the mantle of the mollusk, and that it is cast off with each new layer of shell. We shall presently have to notice the remarkable variations in the microscopic appearance of sections of shell, which are produced by the differences in the manner in which this membrane is arranged. It may be easily obtained by submitting the *internal* layer of any shell (whether nacreous or not) to the action of dilute muriatic acid, until all the calcareous matter has been removed. In the porcellaneous shells it is so extremely delicate, that, when thus separated, it is liable to be overlooked; and it seems to be dissolved by the acid, if left in it for too long a time, or if the acid be too strong.

In certain bivalve shells, however, an entirely different kind of membranous basis remains behind, after the calcareous matter has been removed by acid. This consists of a stratum of *prismatic cells*, adherent together at their sides, and forming by their extremities the two surfaces of the membrane, which thus presents the appearance of a honey-comb. This is most characteristically seen in *Pinna;* nearly the whole of which shell is formed of this *prismatic cellular* substance, as may be easily shown by examining the thin laminæ into which it separates, without any preparation, by the aid of even an ordinary microscope. These cells are usually hexagonal in form, but are not very regularly so. Their size varies considerably, both as to diameter and length, even in the same shell. When very long, the layer which they form will possess considerable thickness;

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* And a term first used by Henle.—[Ed.

when they are very short, it will be delicately thin. The cells are usually the longest in the outer layers. I have seen a recent *Pinna* in which one of these was nearly one-sixth of an inch in thickness; and I have seen this far surpassed in fossil shells allied to this genus, as *Inoceramus*, *Pachymya*, &c.; yet in the very same shells, the inner layers were thinner than a sheet of writing-paper. Although there are considerable variations in the diameter of the cells, in different parts of the same individual, and still more in different species of the same genus, yet there appear to be certain limits; so that some shells may be characterized by the coarseness of their prismatic structure, and others by its fineness. The *coarsest* I have yet met with is in *Inoceramus*, the *finest* in *Pandora;* and the difference is so great, that at least 250 cells of the latter would be covered by one cell of the former (Plate VII, figs. 1 and 2).

The resemblance, in their structure and position, between the prismatic cellular substance of shells, and the prismatic epithelium covering the mucous membranes of higher animals, leaves no room for doubt of their analogy; and we may consider this form of shell-structure in the light of a *calcified epithelium*, the carbonate of lime being deposited in the cavities of the cells, and in general completely filling them. In most sections of *Pinna* a greater or less number of *dark* cells may be seen, which are usually disposed with some degree of regularity. These I have reason to believe to be cells incompletely filled with carbonate of lime; the spaces remaining in which, being occupied by air only, present a dark appearance under the microscope, according to the general principle well known to observers.

I think it cannot admit of a doubt, that the prismatic arrangement of the carbonate of lime in these shells is due to the nature of the organic basis in which it is deposited, and not to anything peculiar in its mode of crystallization. An interesting specimen of *Pinna* has lately been brought under my notice by Mr. S. Stutchbury, in which the thick outer layer had become disintegrated, during the life of the animal, by the decay of its organic structure; and the prisms of carbonate of lime were left *in situ*, but not in any way held together, so that they could be separated by a touch. On treating these prisms with dilute acid, I find them encircled by an extremely delicate membranous film; the remainder of the cells, in which they were originally formed, having been removed by decay.

It is not difficult for a person who has once become familiar with the appearance of this structure, to recognise it by the naked eye, when it presents itself in any considerable amount. It is known by its brownish-yellow colour, its elasticity (which is greater, and its brittleness less, than that of other kinds of shell-structure), and its prismatic or fibrous fracture. I have determined its existence, by thin sections examined with the microscope, in the following recent genera: *Pinna, Avicula (Meleagrina) Perna Malleus* and *Crenatula,* belonging to the family *Margaritaceæ; Ostrea* and *Etheria,* which seem to be nearly related, if not to be included in the same family *Ostraceæ; Unio* and *Anodon,* belonging to the *Nayadeæ;* and *Pandora.* This last genus is the only exception I have met with to the general rule—that the prismatic cellular structure is restricted to the group, of which the *Margaritaceæ* may be taken as the type or centre, the lobes of the mantle being almost or completely open and the foot small; and *Pandora* is altogether so anomalous a genus, that the systematist is greatly perplexed by it on other grounds than this.

The position of *Pinna* among the *Margaritaceæ* (of which it may be considered an aberrant form leading to the *Mytilaceæ*), the alliance of *Etheria* to this group rather than to the *Chamaceæ,* and the separation of the true *Ostraceæ* from the *Pectinidæ* on the one hand, and from the *Placunidæ* on the other, which had been proposed by systematists on the ground of general characters, appear to me fully borne out, and indeed absolutely required, by the characters afforded by the structure of the shell.

I have examined several fossil shells which exhibit similar characters; such as fossil *Pinnæ, Inoceramus, Pachymya* and *Gervillia,* belonging to the *Margaritaceæ; Gryphæa* to the *Ostraceæ;* as well as *Unios,* &c. The prismatic cellular structure is extremely well preserved in nearly all fossil shells; and is very easily recognised, either by fracturing the shell or by making a thin section of it. The latter is necessary where it forms but a thin layer, as in *Gryphæa, Unio,* &c.; the former is sufficient where the layer is thick enough to give the fibrous aspect on fracture.

The determination which the use of the microscope thus enables us to make, of the family to which shells must be referred whose position would be otherwise doubtful, must be, I imagine, of very great use to the geologist, even were that use limited to the few families I have yet named, which is by no means the case. The following will serve as a good example:—A certain shell from the lias has been described and figured by Prof. Phillips under the name of *Avicula cygnipes;* and the same, or a closely allied species by Mr. S. Stutchbury, under the name of *Avicula longicostata.* These gentlemen were not unaware of its affinity to the *Pectinidæ,* but thought that the characters of *Avicula* predominated. On examining a portion of it, however, which Mr. Stutchbury submitted to me, I was able most decidedly to assert, that it possessed the intimate structure of the shell of the *Pectinidæ,* whilst the prismatic cellular structure and nacreous lining of *Avicula* were altogether wanting.

(To be Continued.)

ON THE DIRECTION OF THE FIBRE IN THE INTERIOR OF THE SPIRAL VESSELS OF PLANTS.

By Edwin J. Quekett, F.L.S., &c.

HOWEVER rude the dissection be made of the portions of herbaceous plants which are to be submitted to the microscope, one seldom fails in discovering numerous thread-like organs coiled in a spiral form. These "*fibres,*" in their natural condition, are contained within a cylinder of extremely delicate membrane, where the turns of the fibres, instead of being extended more or less, approach each other. The number of these spiral fibres in any cylinder of membrane, varies even in the same plant, some having only one, others two or more, as many as six, and even other numbers up to twenty are tò be seen in particular orders of endogenous plants, as the Banana and Ginger tribe. In all cases the fibres extend, uninterruptedly spiral, the whole length of the cylinder; and when there are several, they conform to the same spiral, making in appearance what is known as a "double or three or four threaded screw," according to the number of fibres; the vessels being called *simple* when only one fibre exists, and *compound* when more than one.

The direction of the spiral differs in the vessels of different plants, though it is said by Slack,* that "the fibres of a compound vessel are found always to run in one direction, forming usually a right-handed screw." This certainly is not altogether correct, for compound spiral vessels, as well as simple, are not for the most part right-handed screws; but, on the other hand, are perhaps more frequently met with running in the opposite direction.

Various opinions have been offered by botanists, some supposing that the plants of the opposite hemispheres would have the spiral running in different directions; others supposing that in twining plants, the course of the spiral would conform to that of the stem; but both these and other conjectures have been found to be more or less erroneous.

From observations that have been often made on the plants of this hemisphere and the opposite, the only certain fact respecting this matter is, that the vessels have always the fibre rolled in the same direction in the same species; and in the majority of plants examined, the most frequent direction observed is the spiral turning to the left hand, the right-handed screw being very rare by comparison, though it is somewhat singular that in the stem of the garden lettuce, vessels are associated, some of which have the fibre turning to the left and others to the right.

The cause which determines the direction of the twining stems of plants, may be supposed to exert an influence on the deposit and growth of the several elements of the tissues; but it is to be observed, that as regards the course of the fibre within the vessels this does not obtain, for if dissection be made of the stem of a right-handed twining plant, such as *Polygonum convolvulus*, or "the Scarlet Bean," the spirals in the vessels will be found to turn to the left. If the same examination be carried on with a left-handed twining plant, the "Hop,"† the spiral will also be found to exhibit a left-handed course, which appears certainly to be the most common condition under which these organs are found, whether in plants with twining or erect stems;* and apparently no force operating to effect the spiral direction of the stem or other organs of a plant, does necessarily extend an influence of the same kind in the development of the fibre of spiral vessels.

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* Transactions of the Society of Arts, Vol. XLIX.

† An unknown left-handed climbing plant from the East Indies exhibits, as well as fossil wood from the same region, the fibre of the vessels taking a left-handed course.

Reviews and Analysis.

The Analysis of M. Donné's "Cours de Microscopie" *continued.*

In our last Number we gave an account of M. Donné's views of the form, structure, &c. of the red corpuscles of the blood: we shall now proceed to lay before our readers the result of his observations of the colourless corpuscles of the same fluid. These colourless corpuscles have for a very long period been noticed in the blood by many observers, and from their close resemblance to chyle and lymph globules, were generally considered to be identical with these bodies, and even at the present time, they are so regarded by many authors, *e. g.* Müller, Carpenter, &c.; while, on the other hand, some few others with much less reason, are of opinion that they are formed from the central portion of the red discs, and consider them as holding an intermediate position between the true red discs, and those greatly altered forms of them which constitute (according to them) the foundations of the tissues, as well as pus and other globules.†

The principal argument against the identity of these corpuscles with the chyle and lymph globules, is their existence in large numbers in the fœtus, in which there is no separate chyle; but Dr. Carpenter is of opinion that this fact does not weigh in the least against the doctrine of the identity of the chyle and colourless corpuscles of the blood, "since," says he, "the fluid taken up by the omphalo-mesenteric vessels from the surface of the yelk-bag, or that from the placental sinuses by the umbilical vessels, stands precisely in the same relation as chyle;

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* The best method of examining the structure of spiral vessels is to take some leaf stalk, such as rhubarb, or some stem which is not woody, and boil it until it is very soft, when, by separating a portion, the vessels will be distinctly seen entire under a microscope of moderate power.

† See Dr. Carpenter's Report in Brit. and For. Quar. Rev., No. 29, Jan. 3rd, 1843.

the cell-germs of the former being probably furnished by the cells that intervene between the omphalo-mesenteric vessels, and the surface of the yelk, while those of the latter, by the similar layer of cells that covers (according to Mr. Goodsir's observations) the extremities of the absorbent tufts of the umbilical vessels."* But to proceed to the work before us:—M. Donné says, that the discovery of these particles (*colourless corpuscles*) cannot be attributed to any author in particular, but it is only within later times that they have been studied with that care which is necessary to find out their precise nature. The author very properly leaves the discussion of their probable origin until after he has described their form and structure.

He very justly states that they bear no resemblance to the red corpuscles, either in their colour, as their name implies, or in their form or composition. Instead of being circular and flattened as the red discs are, and their surface smooth and regular, they are spherical, and their surface presents a granular appearance, and moreover they are somewhat larger in size, being about $\frac{1}{2600}$th of an English inch, instead of the $\frac{1}{3120}$th. Their interior is filled with solid granulations, commonly three or four in number, instead of an homogeneous and semi-fluid substance like the blood discs of Mammalia, or a single nucleus like those of the three other classes of vertebrate animals. They also comport themselves differently with chemical re-agents, since water does not alter their form, or dissolve them, unless after a very long time, and acetic acid contracts and condenses but does not dissolve them; they resist, however, the action of ammonia, but little better than the red particles. M. Donné observes, that they bear such an analogy in form, structure, and composition, to the globules of mucus, as to render it nearly impossible to distinguish the one from the other. Yet he thinks their intimate nature and their origin may be very different.

The following are the methods which M. Donné recommends to be adopted for isolating them for observation:—

"The white globules have the property of adhering to glass instead of gliding on its surface like the red globules; this circumstance permits of their separation by a kind of filtration, which may be effected under the microscope.

"If we deposit a small drop of blood taken from a prick in the finger upon a slip of glass, and upon this place a slip of thin glass or talc, the blood is introduced rapidly, by the action of capillarity between the two; the red globules are soon scattered between the two surfaces, while the white globules, adhering to the glass, are speedily arrested, and are collected together nearly at the point where the blood has penetrated between the two layers; they form little islets, perfectly distinct, in the middle of this kind of artificial current of the red globules entering by capillarity. When this movement is ended, if we add a little water or acetic acid, the red globules are speedily dissolved, leaving the white globules acted upon in the manner above described, and very favourably placed for observation.

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* See Dr. Carpenter's Report in Brit. and For. Quar. Rev., No. 29, Jan. 3rd, 1843.

"The second proceeding shows them still more palpably. It is necessary to defribinate the blood taken from the vein;* when the blood is thus deprived of its coagulable part it remains liquid, and if we leave it to repose in a vessel it slowly separates into two principal layers, the one red considerable and occupying the bottom of the vessel, the other colourless or yellowish, formed by the serum, and placed upon the first. But between these two layers there exists a third, extremely thin, and which requires a particular attention to perceive it; this third layer forms a kind of greyish very thin pellicle, which lies on the surface of the red layer. The specific weight of these globules being precisely intermediate to that of the serum, and to that of the red globules they accumulate and remain at this point. To observe them by the microscope, we must draw off the serum by means of a pipette, taking care not to disturb the greyish layer. A small drop taken from this layer, and observed by the microscope, presents a multitude of the white globules mixed with some red globules."

These globules can also be readily seen when observing the circulation in the frog's foot, and other transparent parts. Mr. Addison has given a good description of the colourless globules, in the Medical Gazette for 1841.

Globulins.—"The third kind of particles" says M. Donné "existing in the blood does not merit the name of globules, they are, in effect, only small granules belonging to the chyle, which are incessantly poured into the sanguineous fluid. The same proceeding recommended for the obtaining and examining the white globules, serves also to distinguish the *globulins* of the chyle in the blood. They present themselves under the form of little whitish particles, of little round grains, isolated or irregularly agglomerated, and having a diameter of $\frac{1}{7800}$th of an English inch. *They are of great importance, since they are the first elements of the blood globules.*"

It will thus be seen that M. Donné attributed to these little granules, which he believes to be the chyle, the formation of the blood globules; and a little further on he states, "that these granules first form the white globules, and that these globules are intermediate between the red globules and the chyle granules, which are themselves the elements and the first rudiments of the white globules." He attempts to support this opinion by the fact, that the both kinds of globules are not absolutely identical among themselves, from their comporting themselves somewhat differently with the same re-agents, and from some again having a greater tendency to forming rouleaux than others, some remaining isolated. "These differences marking," says M. Donné, "the different degrees of formation or development of the one from the other, and the white globules from the chyle granules." M. Donné has observed in the blood "a certain number of globules which are neither in the state of white globules, nor in that of red globules, and which have some of the properties peculiar to both; and that the observation of the blood in its normal condition enables us to detect a certain intermediate state, a passage of the one to the other, in which there exists a granular appearance, and a resistance to the re-agents, which remind us of the nature of the white globules; while in their yellowish colour, and their flattened and circular form, they sensibly resemble the red globules, properly so-called."

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* This is best done by stirring the blood while flowing from the vein, by means of a bundle of small twigs, when the fibrine will quickly coagulate and adhere to them, leaving the serum and blood corpuscles only.

> "As to the white globules," says the author, "it is still more easy to show their origin, from witnessing the tendency of the granules of chyle to unite in threes and fours, to become enveloped in an albuminous layer or covering, while revolving in the sanguineous fluid; in this way is formed the complex globule, or the white globule composed of a vesicle, with internal granules, by a mechanism which appears to constitute a general law of the economy; the organic element is reduced every where to a vesicle, to a primitive cell, which is organised around a granulation, and the albumen appears marvellously adapted to play this part, in condensing itself around solid particles with which it is in contact. From the analogy which we have pointed out between the mucous globules and the globules of the blood, the mechanism of the formation of these two kinds of globules being the same, produces a result similar in appearance, although the intimate nature of these two kinds of globules may be essentially distinct."

M. Donné moreover thinks he has confirmed the truth of this view of the successive changes in the white and red blood corpuscles, from his observations of the changes which milk undergoes when injected into the veins of animals. "Milk," says M. Donné, "is the best fluid for this purpose, because its globules differ so much in their physical characters from those of the blood, and are, therefore, easily distinguished." He injected milk into the vessels of frogs, birds, and several mammals. Soon after the injection he found in the blood, taken from a different part of the animal from that into which the milk had been introduced, a great number of the milk globules as yet unaffected, intact, as well from their appearance as from their resisting the effects of those re-agents which exercise so much influence in destroying and changing the physical characters of those of the blood. In forty-eight hours he failed to detect any trace of these milk globules, and during the interval between the first and second examinations he carefully analysed the different excretions, especially the urine, the great menstruum for the elimination of accidental foreign matters introduced into the organism, without finding any trace of the elements of milk, either caseum or the globules.

After the injection of from half a drachm to a drachm and a half of milk into the vena portæ of a frog, he observed, from time to time, the circulation in the tongue of the animal. Almost immediately after the operation, he observed the characteristic milk globules freely mixed with the blood and isolated; in a short time afterwards they were aggregated in twos and threes, and in the course of about twenty-four hours he failed to detect them. He concluded from this, and his other numerous experiments, that they became transformed into blood corpuscles, at first the white, and then the red, in a similar way to the chyle granules.

From the great number of white globules found at all times in the spleen, exceeding that of the red corpuscles of the blood taken from other parts of the body, and from his constantly observing all the successive phases of the formation and development of these corpuscles in blood taken from this organ much more palpably than in that taken from any other part, M. Donné is inclined to think, that the transformations of them take place in this organ; that this is, in fact, the proper function of this organ; and that this organ is the laboratory where this transformation takes place. With respect to the function which the perfect blood corpuscle, the red corpuscle, exercises in the economy, M. Donné asks the following questions:—"Are they the last term of the organization of the sanguineous fluid, and do they constitute by their union, by their fusion, the different organs?" He is not inclined to adopt this view; he believes that all organization is effected by blood in a fluid state, and that the globules are gradually elaborating this fluid while passing through their different phases up to the most perfect one, viz., the red. "These globules become dissolved in the blood when they have undergone their different mutations, and when they are sufficiently elaborated; they thus constitute the organizable fluid, in which is found the spontaneously coagulable element, the fibrine, and other materials of organization." This opinion of the office or functions of the red corpuscles, very closely agrees with that of Wagner, Henle, and Wharton Jones. Dr. Carpenter appears to entertain a different opinion, and is disposed to think that this office, the elaboration of the fibrine or organizable plasma, is performed by the white corpuscles, and *not* by the red. Dr. C. adduces the following reasons for this conclusion:—*

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* Op. cit. pp. 272-3.

"The researches of Andral have clearly shown, that in the inflammatory condition of the blood there is a decided increase, often a most astonishing one, in the amount of fibrine; whilst there is no corresponding augmentation in the number of the red corpuscles. Indeed, this augmentation is not incompatible with a chlorotic state of the blood; the peculiar characteristic of which is a great diminution in the amount of red corpuscles. Again, in fact, the characteristic alteration in the condition of the blood appears to be an increase in the amount of red corpuscles, with a diminution in the quantity of fibrine; yet if a local inflammation should establish itself during the course of a fever, the proportion of fibrine will rise, and this without any change in the amount of corpuscles.* By such alterations the normal proportion between the quantity of fibrine and corpuscles, which may be stated as $a : b$, may be so much altered as to become $4a : b$, or $a : 4b$. Can it be supposed then that the elaboration of the fibrine is a consequence of the action of the red corpuscles? Another important fact, having the same bearing, has been ascertained by Remak. He found that when an animal is bled largely and repeatedly, the quantity of red corpuscles in its blood is greatly diminished, whilst the proportion of the colourless corpuscles is increased; now, as it has been ascertained by Andral's investigations, that the quantity of fibrine is but little affected by bleeding, it would seem that the white rather than the red corpuscles are the agents of its elaboration.

"Again, there appears to be a total absence in the blood (?) of invertebrated animals of any red corpuscles† resembling those of the blood of Vertebrata; yet in this fluid the elaboration of albumen into fibrine must be taking place for the nutrition of the tissues, as in the higher animals. It is true, that this nutritious fluid contains globules; but these globules bear a much stronger resemblance to the corpuscles of the chyle or to the colourless corpuscles of the blood, than they do to the red corpuscles of the Invertebrata."

Abstracts from Journals, and Proceedings of Microscopical and other Scientific Societies.

OBJECTIONS OFFERED TO THE OPINIONS EXPRESSED BY MIRBEL, IN HIS MEMOIR ENTITLED "ANATOMICAL AND PHYSIOLOGICAL RESEARCHES, CONCERNING CERTAIN MONOCOTYLEDONOUS VEGETABLES." BY M. CHARLES GAUDICHAUD.

THESE observations are prefaced by the following axiom, "that all organized bodies take their origin from a cell," which cell endowed with vitality, either in an isolated fragment of a vegetable, or in an entire plant, or, lastly, in an ovule, produces always a first individual, simple in the Monocotyledons, double or multiple in the Dicotyledons; and this primitive individual *(phyton)*, which may be the name that one will give to it, such as a bud, bulb, or embryo, will always be a being by itself, having its own organization and peculiar life secured to it. When it shall have attained a certain degree of organization it will give origin to a second individual, simple or double, then a third, a fourth, &c.

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* These conditions of the blood in fever and some of its complications, repeated observations by ourselves have amply verified.

† The red blooded Annelida do not form an exception to this rule. The colouring principle of their circulating fluid exists in its *plasma*, not in the globules.

M. Gaudichaud, after describing that the embryo commences by a cell, and ultimately is composed of one or more rudimentary leaves, which at first do not exhibit traces of vessels, but which in a more advanced state, are to be detected; that "the *(trachèes)* spiral vessels are formed spontaneously in the separated vegetable embryo, by the sole effect of its proper nutrition peculiar to itself."

"If this fact be admitted, which I declare positive, you will be naturally led to admit that the same phenomenon takes place in all other individuals, or *phytons*, which are developed successively, to make up the entire vegetable, even the most colossal."

These vessels are then formed secondly in the primitive cellular substance of the increasing individuals.

On these assertions M. Gaudichaud contradicts the opinion expressed by Mirbel, that vessels of monocotyledonous plants have their origin in the internal cellular tissue of the *(stipe)* stem, and shows that they originate in the leaves and are continued into the stem, and many descend through it and are even continued into the roots. Those which do not pass into the roots "form a thin layer of wood upon the inner surface of the *perixylon*" (internal compact layers of the back).—*Comptes Rendus, tom. XVII., October 9th,* 1843.

THE WATER FLANNEL.

A DESCRIPTION of this singular substance is given in the Gardener's Chronicle, for October 21st, 1843, from which the following is abridged:—

This formation appears to resemble "a coarse kind of flannel, grey on one side, greenish on the other, and a full quarter of an inch thick. It had been thrown up by the river Trent, and washed ashore in vast sheets. Those who had seen it, pronounced it a manufactured article, and so it was, but by the hand of Nature.

"When this substance is handled, it is harsh to the touch, although composed of the finest threads. To the naked eye, it presents no character by which it may be known from any coarse and loosely-woven cloth. The microscope reveals its nature. It is then found to consist of myriads of jointed threads, whose joints are compressed, alternately sideways, and vertically; they are here and there transparent, but for the most part opaque, and rough to the eye. The white side is more opaque than the other, and more unexaminable, but if a little muriatic acid be added to the water in which the fragments of water flannel float, copious bubbles of air appear, which are much increased in quantity by the application of the heat of a spirit-lamp. By degrees they disappear. They were bubbles of carbonic acid extricated by the action of the muriatic acid on a coating of carbonate of lime, with which the plant is more or less completely invested. If after this operation the threads are again examined, the contents of the joints become visible; in the green parts of the flannel they are filled with an irregular mass of green matter, in the white part with myriads of globules, intermixed with a shapeless substance. The globules are the seed. If a little iodine is then given to the flannel, it is readily absorbed, and the contents, shapeless matter, globules and all, become deep violet, showing that all the substance is starch."

"Hence it appears that the water flannel is a microscopical plant, composed of jointed threads, secreting carbonate of lime on their surface, and forming seeds composed of starch within them, and when we consider that the joints are smaller than the eye can detect, while each contains from fifty to one hundred seeds, it may easily be conceived with what rapidity such a plant is multiplied; besides which, as their contents consist to a great extent of starch, the most readily organizable of all vegetable materials, the means of growth with which the plant is provided, are far more ample than anything we know of in the higher orders of the vegetable kingdom.

"This curious substance has of late years attracted the attention of people in various parts of England, and the inquiries that have been made of naturalists, have been so incorrectly answered, that it is fully time to put an end to the mistakes about it.

'The water flannel is really the *Conferva crispa* of Dillwyn, or the *C. capillaris* of Linnæus, known for years for the singular property it has of forming beds of rough entangled curling threads.

It swarms in water, where it floats and grows with inconceivable rapidity—"It is cast by the waters on the meadows, and carries with every 1,000 lbs. weight of it, 400 lbs. of carbonate of lime, and upwards of 200 lbs. of carbon, with at least 15 lbs. of the air called nitrogen."

One quarter of its weight consists of starch and azotised substance; that is to say, of the nutritious matter that gives bread its value. Why then may not the water flannel be converted into food in times of scarcity? It would certainly be far better than the bread of bark and straw, which has been sometimes used.

[We should imagine that many vegetable productions are infinitely better suited to be rendered nutritious than such plants, which are composed of $\frac{4}{10}$ths of their weight of carbonate of lime, besides silica, in fact there can scarcely be found a class of plants that have less vegetable matter in a given weight than this species of fresh water Conferva.]—*Ed.*

RESEARCHES ON THE LOCOMOTIVE ORGANS OF THE SPORULES OF ALGÆ.—BY M. GUSTAVE THURET.

The spontaneous movement of the sporules of *Algæ* has been seen by many observers. In certain cases it is sensible to the naked eye; but until the present, as M. Dujardin declares in his "*Observateur au Microscope*" (Paris, 1843), no one has been able to recognise "by what means the sporules swim in the liquid."

"In fact, the movement of the sporules lasts but a few hours, during which their locomotive organs are in incessant agitation, and, consequently, very difficult to distinguish. The employment of coloured infusions only is capable of making their existence manifest. When the sporule becomes at rest, these organs disappear very quickly, without leaving any traces, and in a short time after germination commences. It is necessary then to watch the precise moment when the sporule ceases to move, in order to bring them into contact with a re-agent, whose action, too feeble to disturb their form, suffices to stop their movements. Opium and iodine have appeared to be the agents the most proper to obtain this result.

"The most simple organization is that that is found in the *Confervæ*, which is believed to represent a general type in the sporules of *Algæ*. I have studied it in *Conferva glomerata, and rivularis:* the spores are in all respects alike in both species. Their form is turbinate—the extremity transparent, deprived of *endochrome* (green granular colouring matter), to which has been given the name of *beak;* bears two *cilia* or filiform tentacles, whose length surpasses slightly that of the sporule. These are the locomotive organs (Plate VI, fig, 6). The sporule moves ordinarily with the beak directed forwards. From time to time the sporule moves suddenly backwards, and often revolves on its longer axis. Light exercises a remarkable influence upon the direction of its course. A very small quantity of the watery extract of opium is sufficient to stop its movements, when one distinguishes easily the tentacles with a linear magnifying power of 240 times. They are rendered still more visible by the employment of very diluted tincture of iodine. Lastly, if the sporules are allowed to dry on a slip of glass, the tentacles are not altered by the loss of moisture.

"It is especially in the morning that the greatest number of the sporules of *Confervæ* are found in motion. Those that are found after mid-day have become quiet for the most part, or have already commenced germination. The sporules that are motionless present always, towards the beak, a rose-coloured spot, which causes a great resemblance with certain Infusoria, especially with certain *Thecamonadiens* (figs. 7 and 8).

"*Chætophora elegans* offers a more complex organization, the beak bearing four tentacles instead of [two. These spores are very small and difficult to observe. Fig. 9 represents them in germination."

In *Prolifera rivularis* and *Candollii* the sporules are oval, the beak rounded, and bears a crown of filiform tentacles (fig. 10), which opium and iodine render motionless. When the sporules germinate, they become fixed by the beak to any body floating in the water, and emit certain root-like processes, which attach them securely.

In several species of *Vaucheria* which were examined, the whole surface of the sporule is covered with these locomotive organs (cilia).—*Annales des Sciences Naturelles, May,* 1843, p. 266.

[From the different groups examined, it is fair to conjecture that the observations of M. Thuret can be further corroborated by the examination of the sporules of other tribes of *Algæ*. So far as they have gone, they undoubtedly prove that in organisms which no one has ever denied to be any other than belonging to the vegetable kingdom there exist *cilia*, analogous to those possessed by animalcules, and by all animals, even up to man, in certain organs ; a fact now beyond contradiction.—Ed.]

RESEARCHES INTO THE STRUCTURE AND DEVELOPMENT OF A NEWLY DISCOVERED PARASITIC ANIMALCULE OF THE HUMAN SKIN, THE ENTOZOON FOLLICULORUM.—BY ERASMUS WILSON, LECTURER ON ANATOMY AND PHYSIOLOGY AT THE MIDDLESEX HOSPITAL.

While engaged in researches on the minute anatomy of the skin and its subsidiary organs, and particularly on the microscopical composition of the sebaceous substance, the author learned that Dr. Gustav Simon, of Berlin, had discovered an animalcule which inhabits the hair follicles of the human integument, and of which a description was published in a memoir contained in the first number of Müller's Archives for 1842. Of this memoir the author gives a translation at full length. He then states, that after careful search, he at length succeeded in finding the parasitic animals in question, and proceeded to investigate more fully and minutely than Dr. Simon had done the details of their structure, and the circumstances of their origin and development. They exist in the sebaceous follicles of almost every individual, but are found more especially in those persons who possess a torpid skin ; they increase in number during sickness, so as in general to be met with in great abundance after death. In living and healthy persons, from one to three or four of these entozoa are contained in each follicle. They are more numerous in the follicles situated in the depression by the side of the nose; but they are also found in those of the breasts and abdomen, and on the back and loins. Their form changes in the progress of their growth. The perfect animal presents an elongated body, divisible into a head, thorax, and abdomen. From the front of the head proceed two moveable arms, apparently formed for prehension: and to the under side of the thorax are attached four pairs of legs, terminated by claws. The author distinguishes two principal varieties of the adult animal; the one remarkable for the great length of the abdomen and roundness of the caudal extremity; whilst the other is characterised by greater compactness of form, a shorter abdomen, and more pointed tail. The first variety was found to measure, in length, from the one-100th to the 45th, and the second, from the one-160th to the 109th part of an inch.

The author gives a minute description of the ova of these entozoa, which he follows in the successive stages of their development. The paper is accompanied by numerous drawings of the objects described.—*Proc. Roy. Soc.*

[The description of these ova will be given in a future Number.]

MICROSCOPICAL SOCIETY OF LONDON.

At a meeting of the Society, held on the 20th December 1843, **Edwin J. Quekett**, Esq. in the Chair, a communication from A. Tulk, Esq., upon certain parasites in the dog, was read. These parasites were found by Mr. Topping, on examining microscopically the contents of the pustules in a mangy dog. They belong to the genus *Demodea* (Owen), first discovered, figured, and described by Dr. Simon, of Berlin, as inhabiting the sebaceous sacs and hair follicles of the human skin. The insects now described as existing in the dog, were found in such abundance, that thirty or forty were frequently seen in a single drop of pus. They differ very slightly from the human parasites before referred to; but analogy would lead to the conclusion, that they are of a different species. The discovery of this parasite may throw some light on the cause of the disease called mange—a disease by no means confined to one class of animals, while at the same time it is far from being certain whether this insect is the exciting cause, or is merely developed during the progress of the disorder.

The Chairman made some observations upon *Tettegonea septendecim*, a North American insect, sent by Professor Bailey, the ovipositor of which, he stated, forms a curious microscopical object. He exhibited specimens of the male and female insect, and also some wood, illustrating the injury done by it. He also laid before the Society some earth from Petersburg, in Virginia, described by Professor Rogers, containing fossil animalcules, and noticed several new forms found in it.

Mr. Ross communicated an interesting observation relative to the daguerreotype process, first noticed by R. H. Solly, Esq. If an ordinary daguerreotype portrait be examined with a power of about 200 linear, the surface in the parts upon which the light has acted, instead of being perfectly smooth, is found to be covered with a series of minute dots or globules, arranged in a hexagonal form. Mr. Ross exhibited this curious appearance in the course of the evening.

A fluid for cleaning glass was also laid before the Society. It consists of a strong solution of nut galls. Glass wiped with this fluid is effectually freed from all greasiness.

Mr. Busk exhibited the achromatic object-glass of a telescope, having a minute Conferva growing between the lenses composing it. Some discussion took place as to whether this appearance was really the effect of vegetation, or produced by a species of crystallization on the surface of the glass.

Microscopical Intelligence, &c.

THE BEST METHOD OF EXAMINING THE CIRCULATION OF THE BLOOD.

The organ which, on account of the complexity of its structure, is the best adapted for examining the circulation of the blood, is the tongue of the frog, for in this organ enter nearly all the anatomical elements, arteries, veins, capillaries, muscles, nerves, glands, membranes, &c., representing, in a word, nearly every kind of organization in a small compass. The following is the method of preparing this organ for examination under the microscope, without endangering the life of the animal, and which can be repeated a great number of times in the same frog. A piece of cork, about two to three inches in breadth, and six to eight inches in length, is to be procured, in which is to be bored a hole of about half an inch in diameter midway between the sides, and about an inch and a half to two inches from one of its ends. In this part the piece of cork should be of double thickness, which is effected by joining by means of one of the cements alluded to in our " Hints to Microscopists," in the October number of this Journal, a small piece of cork upon the first piece. Upon this is laid the frog, previously enveloped in a linen band, or fixed to the cork by pins thrust through the four extremities, so as to prevent any great movements with its body or with its feet; it is placed upon the back, the end of the nose abutting on the border of the hole. The tongue, the free end of which is directed backwards, is then to be drawn out of the mouth gently with a forceps, and slightly stretched and elongated until it reaches a little beyond the opposite edge of the hole, where it is to be fastened by two pins, the sides are to be fastened over the hole in a similar way. In this state, the tongue presents the appearance of a semi-transparent membrane, which permits us to see through its substance; and when placed between the light and the object-glass of the microscope, offers one of the most beautiful and marvellous spectacles which can possibly be witnessed.—*A modification of a plan recommended by M. Waller.*

DESCRIPTION OF THE PARTS SHOWN IN THE TONGUE OF THE FROG, AS ABOVE PREPARED.

In examining the tongue of a frog extended as above directed, with a magnifying power of 80 linear, we perceive in the first place, the great arterial and venous trunks, which may on the first glance, be confounded with each other, but which we may easily distinguish by the following characters: 1st, in the arterial trunks, the course of the blood is much more rapid than in the veins; 2nd, the arteries divide in the direction of the current of blood, while, in the veins, the division, and the ramification of the branches, take a direction contrary to this movement; in other words, the arterial trunks divide to form branches, while, in the veins, the branches unite to form the trunks. We remark also, that the arteries are less numerous, and have a smaller diameter than the veins; the arteries of a certain volume are, moreover accompanied by a flexuous and greyish band or cord, not very distinct at first, but which is plainly to be seen by a little attention, upon the side of the vessel; this band, or somewhat flattened cord, is the nerve—the arterial trunks divide into branches, and ramifications, then into little arteries more and more fine, until they arrive at a point where the diameter is just sufficient to admit the blood-corpuscles one by one, and following each other; the little arterial vessels do not appear to diminish in their diameter any further. It is at this point that the capillary net-work commences, which is not to be distinguished from the last ramifications of the arteries, nor the first radicles of the veins. We see here the corpuscles follow each other at a certain distance, and leaving between each an appreciable interval, when the current of the blood is not very rapid.

If care has been used to leave the edge of the tongue free in any part of the opening of the piece of cork, the current of the blood can be followed even from the last extremities of arteries to its return by the venules, to re-unite in the veins, and return to the heart.

It is not, however, always easy to follow thus in all its extent the circulatory circle, or, at least, without losing the view of a portion of the sanguineous fluid, a globule (this last is absolutely impossible), from the moment where it arrives by the artery, to that where it returns by the vein, after having accomplished its circuit. The movement of the blood is on one side very rapid, and, on the other, the division and sub-division of the vascular system does not permit us thus to follow the globules singly; they undergo often in their course such numerous windings—at one time passing directly from a principal artery into a large venous trunk (?), by means of a very small artery which seems to go from one to the other, at other times penetrating into the secreting organs, in the centre of which the blood turns round so rapidly in the vessels reflected upon each other, that we cannot distinguish the entry or exit of the sanguineous fluid in this kind of vortex.

The vascular system is laid out upon a grey semi-transparent ground, in which may be distinguished a multitude of fibres taking different directions, and forming sometimes many superimposed planes and crossings; these belong to the muscles of the tongue, but the fundamental characters of the elementary fibre of voluntary muscle is not recognisable: * yet their essential property of contractility is manifested every moment under our eyes during this experiment; and this contraction itself does not take place in a zigzag, nor in a spiral manner, as is often

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* See remarks on Muscular Structure at p. 97.

supposed; it is a simple retraction of the fibre, as in a thread of caoutchouc, without any appreciable modification of the substance. (The power used by the author was not sufficient.)

This experiment not only enables us to observe the muscular contraction, but also that of the circulation. If we succeed in raising and reflecting a portion of the mucous membrane, at the same time leaving an important vessel, we have a part of perfect transparency, which is composed of muscular fibres, covered by blood vessels, and reposing upon the mucous membrane on the inferior surface of the tongue. In examining the circulation in this organ, we have an opportunity also of seeing the capillary circulation in its mucous crypts or follicles, and at the end of the organ, by a higher magnifying power (say from 250 to 300), the cilia on the epithelial cells may be seen.—*Donné, Cours de Microscopie.*

ON A NEW FORM OF MICROMETER.—BY GEORGE JACKSON, ESQ.

In using the microscope as an instrument of scientific investigation, it is very desirable to have a ready mode of ascertaining the dimensions of the objects observed.

The screw micrometer is the instrument generally used for this purpose, and a more delicate one can hardly be desired. It has however the disadvantage of being expensive, and also of being easily rendered useless, by the accidental breaking of the cobwebs. Its weight, also, upon an instrument of a slight construction, is a serious objection.

In a paper read before the Microscopical Society, Sept. 23rd, 1840, and published in the Microscopical Journal for March, 1841, I pointed out a mode by which a divided glass micrometer might be made to answer the same purpose with a considerable degree of accuracy, and at a very trivial cost. The object of the present communication is to lay before microscopists some improvements in the plan then proposed; and I shall at once proceed to describe the manner of carrying it into effect that is at present practised byMr. Smith, of Ironmonger Row, St. Luke's.

His microscopes are generally furnished with three negative eyepieces; and it is to the middle one of these that he applies the micrometer. He mounts the slip of glass in a thin brass frame, similar to those used by the late Mr. Coventry, and he makes this to slide easily (under a spring) through slits in the opposite sides of the eye-piece; which, when not in use, are closed by the quarter revolution of an internal tube having similar slits. The upper lens has a slight adjustment, to enable the observer to obtain a clear view of the divisions on the glass; which, in accordance with the suggestion of Mr. Lister, have been cut the fortieth of an inch apart, with one of the spaces divided into five by finer lines. The sliding of the micrometer allows the finely divided portion to be readily brought to one edge of the object to be measured, and the divisions can be more easily counted than when the whole field is occupied by close lines. The lines also have been rendered very visible by being blackened with plumbago, which is preserved by a piece of thin glass cemented by Canada balsam, so as to allow the micrometer to be wiped with impunity.

As the measurement is applied to the magnified image, it is obvious that the value of the divisions will vary with the object-glass and the length of the tube, and must be ascertained by reference to another micrometer placed on the stage, the manner of doing which is described in the paper referred to. With an object-glass one-eighth of an inch in focal length, the fine divisions above mentioned are equal to twenty thousandths of an inch; and, as each space may be divided by the eye into at least three parts, the diameter of an object can be taken to the sixty thousandth. With finer divisions and a practised eye, still greater delicacy may be obtained. A table of the value of the divisions with each object-glass is furnished by Mr. Smith; and, by means of a draw-tube, such numbers are obtained as can readily be used in mental calculation. The micrometer can be instantly withdrawn, and the eye-piece used without it, so that the expense of an additional one is avoided.

In applying the glass micrometer to the microscope, Mr. Ross adopted the positive eye-piece generally, and with astronomical telescopes that are furnished with wires. This enables the observer to see the lines free from distortion over a large field, but the edges of the object not being quite free from colour, are less distinct than with the ordinary negative eye-piece. On this account I have preferred the latter; and if the object to be measured be brought to the centre of the field, and do not occupy much more than half its diameter, no distortion can be perceived.

CRYSTALLINE MATTER ON WINDOWS IN THE METROPOLIS.

In the last Number, from the minute quantity of the substance on any given portion of glass that could be analysed, it was stated that it was probable that the crystals were composed of *sulphate of ammonia*, as the result obtained favoured such an inference; by proceeding in the following manner no doubt can exist of the correctness of that assertion.

If a small piece of sponge be first washed in distilled water, and then applied to wash off the deposits on the glass, and then re-washed in another portion of distilled water, a considerable quantity of the deposit can be obtained in solution. If now to this, be added a solution of chloride of barium, a heavy precipitate falls, indicating some sulphate. If lime water be added after, and a small piece of moistened red litmus paper be suspended over the liquid, it will speedily become blue, indicating that ammonia is set free.—E. J. Q.

Since the publication of our last Journal we are informed that Mr. Ross, in the continuation of his endeavours to enlarge the aperture of achromatic object-glasses for microscopes, has succeeded in extending the angular aperture of his $\frac{1}{8}$th inch focal length, to 80 degrees, with the advantage of such an extensive adjustment for the thickness of glass covering the object, that the thinnest glass is not required. With this aperture the greatest effect of amplification and intensity combined is produced, at a magnifying power of 650 diameters, but the most delicate and closest markings on the scale of the *Todura* (those only $\frac{1}{40000}$ of an inch asunder) may be magnified to 1,100 diameters, and still be most perfectly defined.—Ed.

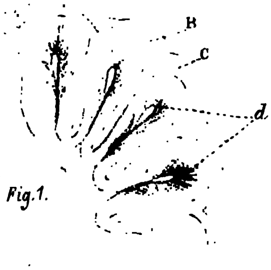


Fig. 1.

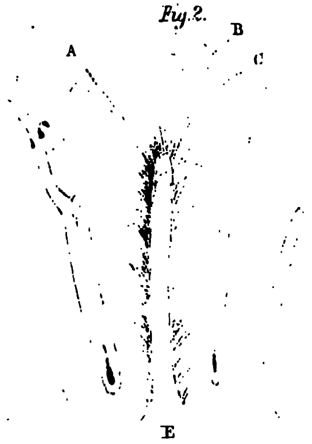


Fig. 2.

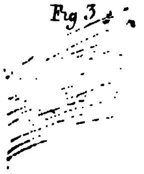
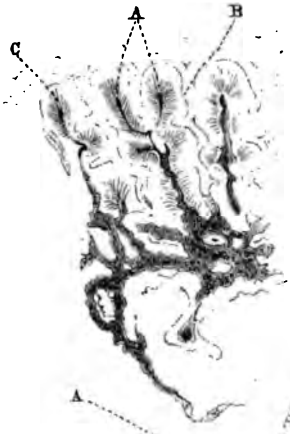


Fig. 3.



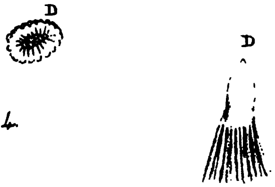


Fig. 4.

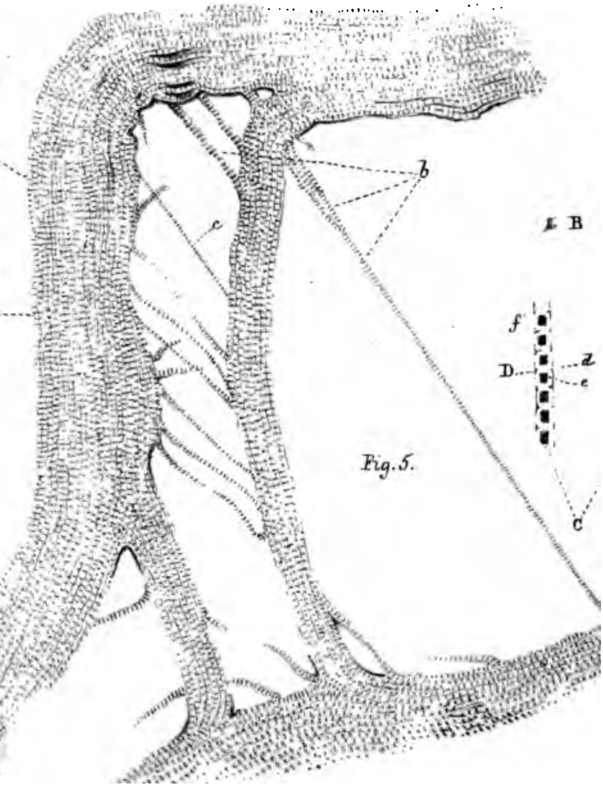
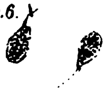


Fig. 5.

g. 6.



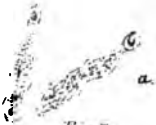


Fig. 7.

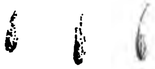
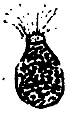


Fig. 9.



g. 10.

STRUCTURE OF SHELLS.

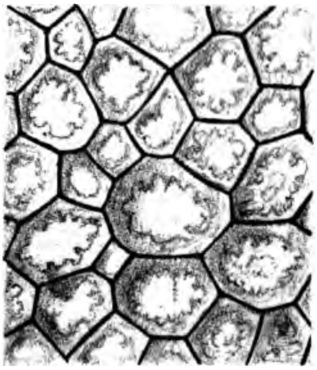


Fig. 1
Decalcified membrane of Pinna.

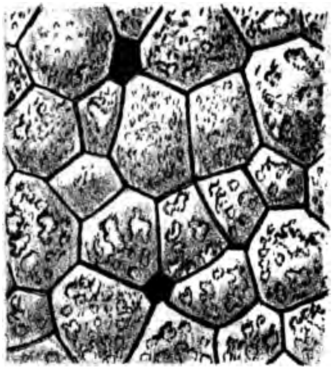


Fig. 2.
Section of Shell of Pinna.

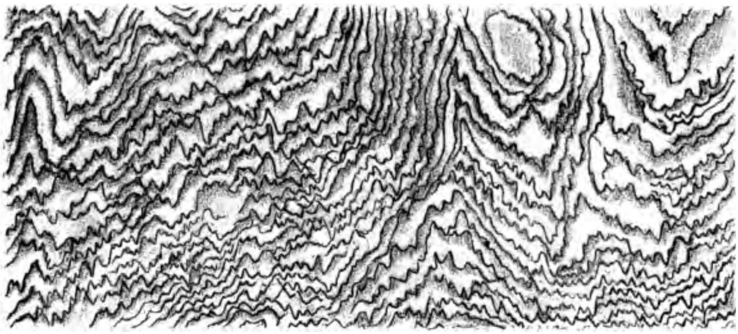


Fig. 3.
Section of Nacre.

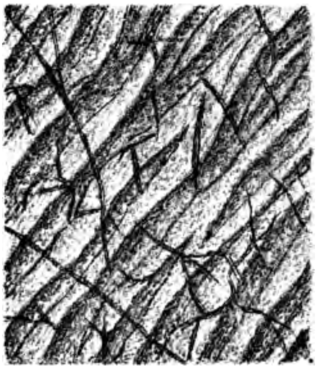


Fig. 4.
Section of Avicula (?) longicostata.

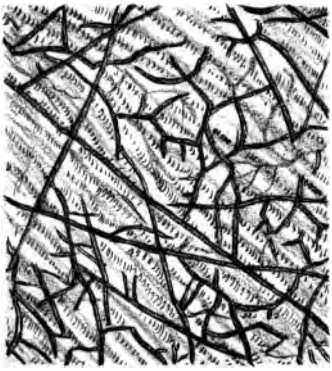


Fig 5.
Section of Lima rudis.

[illegible] imp.

GENERAL RESULTS OF MICROSCOPIC INQUIRIES INTO THE MINUTE STRUCTURE OF THE SKELETONS OF MOLLUSCA, CRUSTACEA, AND ECHINODERMATA.

By William B. Carpenter, M.D.

[Concluded from page 112.]

THE prismatic cellular structure always occupies the *exterior* of the shells in which it occurs; and their inner surface, as well as the whole thickness of a large number of shells, is formed of *membranous* shell-structure, by which I designate that structure which seems to consist of alternating layers of carbonate of lime and of the very delicate membrane already described. This membrane is seldom or never *flat*, however, but is folded into plications like those of a frill, or corrugated into wrinkles like those on morocco leather, or arranged in other ways which cannot at present be fully described, but which are characteristic of particular families. These modes of arrangement determine the mode in which the carbonate of lime is deposited, so that they become perfectly evident when a thin section of a membranous shell is examined with a microscope; and they also determine the appearance produced on fracture. Thus Mr. Gray has pointed out the alternating directions of the rhomboidal crystals seen on fracturing a porcellanous shell, such as *Conus* or *Cypræa;* and these I believe to be entirely due to the alternating directions of the membranous corrugations, which are shown by a section. In like manner, the prismatic fibrous appearance, which is presented by *Mytilus,* and by *Septaria* (*Teredo*) *gigantea,* on fracture, is due to the peculiarity in the form and direction of the plications of the membranous basis; and the microscopic appearance of the latter corresponds so precisely with that, which is to be seen in well preserved specimens of the fibro-calcareous sheath of this *Belemnite,* that I cannot but regard the structure of this interesting fossil as completely analogous to that presented by the thick tube of the recent *Septaria.*

There are two varieties of the membranous shell-structure, which are produced by marked peculiarities in the arrangement of its organic base; and which are so easily recognised by the microscope, as to become of great use in determining the characters of fossil shells. The first of these exists in *nacre*. That the nacreous lustre is due to lines or striæ, occurring within certain distances from each other, was long ago shown by Sir D. Brewster; but my inquiries into the constitution of nacre have led me to a view of their cause somewhat different from his. Instead of regarding them as produced by the alternation of numerous layers of membrane and calcareous matter, I have ascertained that they are due to the plication or folding of a single layer, in such a mode that the folds shall lie over one another in an imbricated manner (fig. 3). The edge of each fold therefore marks a line; and the distance of the lines from each other will greatly depend upon whether the cutting-plane coincides with the plane of the folds, or is more or less inclined to them. As the curvature of the layers of shell causes the cutting-plane to traverse them differently in different parts, a single slice of nacre will often show great varieties in the disposition of the lines; just as the same deal board shows the woody layers very differently divided in its different portions.

The view I have given of the structure of nacre is fully proved, I conceive, by the following fact. It is occasionally possible to obtain a single layer of nacre, the *membrane* of which, after the complete removal of the calcareous matter by acid, exhibits the true nacreous lustre, so long as the arrangement of its folds remains undisturbed; but as soon as the membrane is extended, so as to obliterate the folds, the nacreous lustre departs.

I have found approaches to the nacreous structure in many shells, in which the folds are not sufficiently regular for the characteristic lustre to be exhibited. It is easy to understand, therefore, why there should be a variation in this respect, within the limits of a single genus. Thus in *Ostrea* there is usually no perfect nacre, yet there are species which are truly nacreous. On the other hand, in *Mytilus* there is usually a truly nacreous interior, yet there are species in which this is wanting. When so very slight a difference in the arrangement of the folds will produce this variation, it is not surprising that it should occur among the species of the same genus.

The nacreous and even the subnacreous structure may be easily recognised by the microscope, wherever they occur, both in the recent and fossil state. It sometimes requires a microscope of very good defining power, however, to separate the lines. As it frequently happens that a nacreous *structure* is thus shown to exist in fossil shells, where, from some peculiarity in the fossilization, the characteristic *lustre* does not present itself, I should imagine that this microscopic character must frequently be of great importance to the geologist. The absence of any vestige of it was one of the grounds on which I felt justified in determining that the so-called *Avicula*, just now mentioned, could not belong to that genus.

The other peculiar form of plicated membranous structure is that which presents itself in *Terebratula* and other allied genera of the group of Brachiopoda. It is difficult to give, in words, a description of this peculiarity, but it will be at once understood by reference to figs. 6 and 7, Plate VIII; and, when once seen, is always recognisable with facility. The best mode of showing this peculiar structure I have found to be, the detaching very thin shreds with the point of a penknife; this is very easily accomplished in many fossil species, especially those deeply plicated ones which are usually ranked among the *Terebratulæ*, and best, among recent species, in the *Terebratula psittacea*. It is by the appearances exhibited by these *natural laminæ*, (fig. 7), that those presented by artificial sections (fig. 6) must be interpreted. This kind of structure is to be seen in *Terebratula*, *Spirifer*, and *Pentamerus*. In *Producta* there is a difference in the mode of plication, which takes on the *nacreous* character; and it is interesting to remark, that whilst, in the structure of this shell, there is an approach towards the Lamellibranchiata, there is, among the *Placunidæ* (which probably, of all Lamellibranchiata, approach nearest to the Brachiopods) a manifest tendency, in the peculiar lamination of the shell and in the arrangement of the nacreous plications, to the characteristic structure of *Terebratula*, &c.

One of the most interesting points in the structure of *Terebratula*, or, at least, in certain species of it, is the existence of a large number of tubular perforations, passing directly from one surface of the shell to the other, and terminating by an orifice at each (fig. 6). The size of these perforations is sufficiently great to enable them to be detected with a hand magnifier, as minute punctations on the surface; and in this manner I have observed them in all the recent species of *Terebratula* (about fourteen) which have come under my notice, except in the *Ter. psittacea,* which departs so widely from the general type, in the incompleteness of the passage for the ligament, that (as Mr. S. Stutchbury has suggested to me) it is probably to be considered as the recent type of *Spirifer.** Of the very numerous fossil species of *Terebratula,* I have yet examined but a small proportion: yet the curious result has uniformly presented itself, that the perforations have invariably been found in the non-plicated or moderately plicated species; whilst they have been absent in those which differ from the recent species, in being much more deeply plicated. Now the structure of the shell in the genus *Spirifer* agrees with that of *Terebratula* in every respect, save the absence of these perforations;† I should therefore be inclined, from this character alone, to place *Ter. psittacea* in the genus *Spirifer,* and to refer to the same group those deeply plicated species, which are usually ranked with *Terebratula.* Whether this be thought a correct determination or not, I think no doubt can be entertained, that the presence or absence of these perforations affords a most important character, by which the genus *Terebratula* may be divided. I should mention, that the determination of this character cannot be certainly effected, in fossil species, without making a section of the shell; since the perforations are often filled up with stony matter, in such a way as to obliterate the punctations on the surface.

The diameter of these perforations in *Terebratula* is usually about ·0006 or ·0008 of a inch. In *Producta* they are larger, being about ·0010 or ·0012 of an inch; and they are readily discernible with the naked eye in thin sections or in fractured pieces of the latter. They are readily distinguishable in the decalcified membranous basis of the recent species, and are obviously lined by distinct membranous tubes. I am much inclined to believe that these tubes are prolongations of the mantle, which Mr. Owen has observed to possess an unusual adhesion to the shell.

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* I have since learned, that this species has been separated, and made the type of a new genus, *Atrypa.*

† This statement applies only to the Spirifers of the carboniferous limestone; for in the *Spirifer Walcotii* of the lias, which I have recently examined, the perforations are present, as in the true *Terebratulæ.* The whole subject will require very careful investigation before any legitimate conclusions can be drawn from this kind of examination, in a group of the value of whose several characters we at present know so little.

I cannot but think that the value of the microscope, as an instrument of geological research, must be at once evident from these statements. The genera *Terebratula*, *Spirifer* and *Producta** may be at once distinguished from each other, and from all other shells, by the characters supplied by a fragment of shell, which a pin's head would cover.

Whilst upon the structure of the Brachiopoda, I may mention (though rather anticipating my next head) that the genera *Lingula* and *Discina* (*Orbicula*) agree with each other, and differ entirely from the rest, in a very peculiar set of characters:—their shells possess extremely little calcareous matter, being made up of thin horny plates adherent to each other; every one of these horny plates, however, is traversed by a set of very minute tubuli running aslant through it, and very closely resembling, both in size and arrangement, the tubuli of *dentine*, and those which I have observed in the shell of Crustacea. I have nowhere else discovered, among Mollusca, a structure which could be mistaken for this. Consequently these two genera are at once separated, by microscopic examination, from all others.

The *tubular* variety of membranous shell-structure, as it exists in the shells of certain Lamellibranchiata and Gasteropoda, is the last form which I have at present to describe. The size of these tubuli varies from about 1-20,000th to 1-3,500th of an inch; but their general diameter, in the shells in which they most abound, is about 1-6,000th of an inch. The direction and distribution of these tubes are extremely various in different shells. In general they form a network which spreads itself out in each layer, nearly parallel to its surface; from this network branches seem to pass both upwards and downwards, as if to communicate with corresponding reticulations in other layers. The most characteristic example of this kind which I have met with, is in the genus *Lima*, of which the whole shell is minutely traversed by these reticulated tubes, (fig. 5). In most families whose shells are entirely *membranous* (that is, destitute of the prismatic *cellular* structure), I find the tubular structure present in some genera and absent in others; so that I am inclined to think that it may serve as an important aid, in separating genera which are otherwise closely allied.

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* If I am correct in the characters I have assigned to them.

The tubular structure is often well preserved in fossil shells, and is distinctly seen in the *Avicula longicostata* already referred to. As this example is one of peculiar interest, in regard to the value of the microscope in determining the nature of fossil shells, I subjoin a summary of the characters by which I judge it to be *not* an *Avicula*, but nearly allied to *Lima* or *Plagiostoma.*

Avicula, and other Margaritaceæ.	*Avicula (?) longicostata.*		*Lima, Plagiostoma, and allied Pectinidæ.*
External layer.	*External layer.*	*External layer.*	*External layer.*
Prismatic cellular structure.	No cellular structure.	Coarsely plicated membranous structure.	Coarsely plicated membranous structure.
Internal layer.	*Internal layer.*	*Internal layer.*	*Internal layer.*
Nacreous.	Not nacreous.	Tubular structure.	Tubular structure.

It is worth notice, that in the genus *Pecten* there is not the slightest trace of the tubular structure, whilst the shell of *Lima* is more completely tubular than any I have examined. Hence we might consider the difference between them to be more than *generic;* a conclusion which harmonizes exactly with that of M. Deshayes, founded upon the structure and habits of the animals by which these shells are respectively formed.

The foregoing may be regarded as *specimens* of the important results which I think may be anticipated, from the application of the microscope to the structure of shells. When once marked differences in the arrangement of the organic elements of shell are shown to exist, the question naturally arises, how far these may be adopted as characters in classification; and I think it will be evident, from the facts I have stated, that this may be done to a very considerable extent. There are several families among which I have not yet discovered well-marked points of difference, especially in Univalve shells and in Lamellibranchiata with the lobes of the mantle united, but I have little doubt that such characters may be ascertained, by a more extended inquiry than I have yet had the opportunity of making. Except in the case of *Pandora*, to which I have already adverted, I have not met with a single exception to the rule—that marked differences in the structure of shell go along with marked differences in general characters, and that a close correspondence in the structure of the shell may be held to indicate a tolerably close natural affinity. Many circumstances which at first appeared to me *exceptional*, were explained in the course of my investigations, by my finding (chiefly from the *notes* of M. Deshayes to the new edition of Lamarck) that the views of systematists had recently undergone modification, on several points, from increased knowledge of the structure of the animals, *so as, in fact, to become precisely accordant with the inferences which I should have been disposed to draw from the structure of the shell alone.*

In concluding this part of my subject, it may be interesting to my geological readers, if I say something in regard to the effects of *fossilization* under different circumstances on the structure of shell. The fossil shells I have examined have been chiefly from the carboniferous or mountain limestone, lias, and oolite. Those from the carboniferous limestone are frequently changed by a process of crystallization to such a degree that no organic structure is discernible in them; but the characteristic structure of the Brachiopoda is usually well preserved. The *membranous* shells of the *lias* are usually well adapted for microscopic inquiry; but they split with unusual facility into layers, as if they had undergone very prolonged maceration. The *cellular* shells, from the same cause, are disposed to disintegrate into their component prisms, so that it is difficult to prepare them for the microscope. On the other hand, the *membranous* shells of the oolite are apt to be entirely changed by crystallization, so that not a trace of the organic structure is preserved; whilst the structure of the *cellular* shells is remarkably perfect, and even the membrane which separates the prisms is in some instances preserved. I have not found shells from the *chalk* good subjects for microscopic examination: their texture seems to be permeated by chalky particles, which give it a peculiar opacity, resembling that which is seen, from the same cause (occurring in the natural formation of the shell), in *Ostrea*, *Fusus despectus*, and other shells distinguished by their opake-white aspect.

Crustacea.

In regard to the microscopic structure of the hard envelopes of Crustacea, I can as yet only speak from examination of the common Crab and Lobster; but the facts which this examination has disclosed are so curious, as to render it desirable to state them in this communication.

The envelope of the crab and lobster consists of three layers: internally a thick calcareous layer, the surface of which is raised up in little papillary elevations; upon this lies a layer of *pigment cells*, to which the colour is due; and externally is a structureless horny epidermis. The pigment cells fill up the valleys or intervals between the papillary elevations of the calcareous layer, but do not cover the latter; the epidermis, which is quite smooth, lies flat upon the whole, adhering to the tops of the papillæ; so that, when the shell is closely examined from the outside, it is seen to have a minutely speckled appearance, the red ground given by the pigment cells being studded with the white tops of the papillæ which rise up through it.

The calcareous layer is composed of a substance exactly analogous to ivory, being very transparent and apparently homogeneous, when cut into very thin slices, and being perforated by an immense number of minute sinuous tubuli, which run nearly parallel to one another from one surface of the shell to the other. This arrangement may be seen by making a thin section of any part of the shell; but it may be shown particularly well in the end of the claw, which is thicker and of denser texture than the rest. A transverse section of this shows the tubes radiating from the central cavity towards the external surface, and would, I feel assured, be regarded by the most experienced observer as the section of a tooth, if he were not informed of its real nature.

Echinodermata.

The microscopic structure of the shell of *Echinus* has been very completely analysed by Valentin, in his monograph of the anatomy of that genus, published last year in the beautiful work of M. Agassiz on this group. Before becoming acquainted with his researches, I had arrived at conclusions exactly identical, and had extended my inquiries to all the other most important genera of the *Echinida*, *Stellerida* and *Crinoidea*. The result has been extremely interesting. Every part of the skeleton in these groups is made up of a structure so uniform, and at the same time so unlike every thing else, as to be most characteristic of the group; so that there could be no hesitation, wherever the merest fragment of this structure might be distinguishable, in pronouncing it to have belonged to an Echinoderm. I have reason to believe, that minute calcareous plates, having an identical structure, occur beneath the integument of some *Holothuridæ*; if this be the case (which, for want of a specimen, I have not yet had the opportunity of ascertaining) the universality of the character, as distinguishing the whole group of *Echinodermata*, will be completely established.

The structure to which I allude consists of a series of very thin plates, each perforated by a number of round apertures, disposed with tolerable regularity, so as to give it the appearance of a *cullender*. These plates are connected with each other by little vertical pillars, which pass from surface to surface in vast numbers: hence, when a section is made perpendicularly to the surface of the plates, a kind of network is seen, formed by the cut edges of the plates and by the pillars. In the *shells* of *Echinus*, *Cidaris*, *Spatangus*, &c., these plates run nearly parallel to the surface, and are of course nearly plane; whilst the pillars are perpendicular to these, so that the interstices of the network are nearly square: but in the *spines* of *Cidaris*, *Echinus*, &c., the plates are disposed in a cylindrical manner round the central axis, and the network which is displayed by a transverse section is arranged in concentric rings. The *pattern* of this network in many spines is of the most wonderful beauty and elaborateness; and, as far as I have yet examined, it is so regular in the same species and so different in others, that I am inclined to believe that it will become most valuable in the distinction of species.

A similar cylindrical arrangement, producing the same effect, is seen in the stem and arms of the recent *Pentacrinus*, thin sections of which are extremely beautiful objects for the microscope.

Contrary to the expectation of some of my mineralogical friends, I have been able to discover the same structure in fossil specimens, in which the crystallization was so complete, that they could not be cut without great difficulty, on account of their tendency to cleavage. This has been the case with the *Crinoidea* in general; a definite structure being presented by nearly all the specimens that I have yet examined, though it has been more evident in some than in others. The structure of the round stemmed species is usually very simple; a transverse section exhibiting several concentric rings or layers, like those of exogenous wood, with no variety in the pattern of the reticulation. But in the *Pentacrinites Briareus* the structure is extremely complex. From the centre there proceed five medullary rays (if so they might be designated), from the edges of each of which are given off numerous side branches; and the reticulations of the central portion and its prolongations are very distinct from those of the periphery. Now in the recent *Pentacrinus Caput Medusæ* the pattern is simpler; for though the medullary rays exist, they do not send out lateral branches, and their structure is not so different from that of the portion that surrounds them. In a fossil species, supposed by Mr. Miller to be identical with the recent one, I have found the structure of the stem to be intermediate between that of the *Pent. Briareus* and that of the *Pent. Caput Medusæ;* the medullary rays sending out *short* prolongations, which soon lose themselves in the surrounding structure. I cannot but suppose, therefore, that analogous differences might be found among other species of *Pentacrinus*, and that indubitable specific characters (which are much wanted in this genus) might be established upon these.

In conclusion, I desire to make it known among those who may feel an interest in this inquiry, and who may perceive its importance, that I shall feel particularly obliged by being supplied with specimens for examination; that by extending the basis of my inquiries, my general conclusions may acquire a value and stability which I am conscious that they do not at present possess. Single or imperfect valves of any of the rarer recent genera, and fragments of almost any fossils in which the shelly structure is well preserved, will be gratefully received by me, and I shall do my best to make them available for the purposes of science.

ADDENDUM.

Having been encouraged by the British Association to carry out these investigations, and having been requested to furnish a detailed Report on the Microscopic Structure of Shells, &c. for its next meeting, I am particularly anxious to lose no time in examining as large a number of species, both recent and fossil, as I may be enabled to do, by the kind assistance of those who may be disposed to promote my object. Any contributions of the kind specified above may be forwarded to me direct through the post-office if not too bulky; and Mr. Lovell Reeve, King William Street, Strand, and Mr. Woodward, Geological Society, have kindly undertaken to assist me, by receiving and forwarding to me any specimens that may be transmitted to them.

I may subjoin, as interesting results of observations made since the meeting of the Association, the identification of the remarkable structure of *Pleurorhynchus Hibernicus (Cardium Hibernicum)* with that of *Hippurites* and other *Rudistes;* leaving no doubt in my own mind of their close affinity, this structure being, so far as we know at present, peculiar to the last named group. It has given me great pleasure to learn, that several intelligent conchologists had formed the same opinion on independent grounds; though, so far as I am aware, it has never been put forward in print, and I was entirely ignorant of it at the time my own observations were made. The structure in question is of a *cancellated* nature, filling up the space between the internal and external layers of shell, in the same manner as the *diploe* fills up the space between the tables of the skull. The *cancelli* are very regular in form and arrangement; and though they are now filled with carbonate of lime, I think its appearance indicates that it is the result of fossilization. I am not acquainted with cancellated structure exactly resembling this in any recent shell; the nearest approach to it is presented by *Balanus, Coronula,* and other sessile Cirrhipods; and I am much inclined to believe that the real place of this perplexing group will prove to be intermediate between the Conchifera and the Cirrhipoda—an idea which has derived confirmation from the examination of the very beautiful series of specimens in the collection of S. P. Pratt, Esq., which it is to be hoped that he will take an opportunity ere long of communicating to the public.

I may state, that the specimens most acceptable to me at present are those of the various genera of Brachiopoda; as I am very desirous of fully investigating this group before making my first Report. But I shall be very glad to receive *any* others, provided that the name of the shell is specified, when a fragment only is sent; and the bed from which it is obtained, if it be a fossil.

Bristol, Nov. 16, 1843. W. B. C.

Explanation of Plates VII, VIII.

Fig. 1. Appearance of the membrane of a thin layer of the outer part of the shell of *Pinna*, taken parallel to the surface, after removal of the calcareous matter by acid.

Fig. 2. Thin section of the outer part of the shell of *Pinna*, not acted on by acid; two small black cells are seen, in which the calcareous matter is deficient.

Fig. 3. Section of Nacre, showing the wavy, but usually parallel lines, produced by the plaiting of the basement membrane.

Fig. 4. Section of *Avicula* (?) *longicostata*, showing its coarsely corrugated structure penetrated by tubes.

Fig. 5. Section of the inner part of the shell of *Lima rudis*, showing a finely corrugated structure abundantly traversed by tubes.

Fig. 6. Section of *Terebratula* (recent), showing its peculiar structure, and the large perforations by which the shell is traversed at right angles to the surface.

Fig. 7. Shred of *Terebratula* (fossil) detached by the point of a knife, from a deeply plicated specimen; the difference of aspect between this specimen and the last is entirely due (except in regard to the perforations), to the mode in which the section is made; a natural lamina being obtained in the one case, whilst in the other the plane of section traverses the natural laminæ obliquely.

Fig. 8. Section of the tooth of *Mya arenaria*, showing a remarkable crystalline arrangement.

OBSERVATIONS ON THE SPECIES OF FOSSIL ANIMALCULES DISCOVERED AT PETERSBURGH IN VIRGINIA.

By Edwin J. Quekett, F.L.S., &c.

By submitting to the microscope portions of the several strata which compose the upper crust of the earth, we are made acquainted with the astounding fact, that organisms, so minute as to escape the notice of the unassisted eye, have been employed as agents in accumulating the materials of the surface of the globe—a fact so little expected, and without parallel, where creatures of such tiny dimensions achieve such prodigious results.

Those familiar with the use of the microscope have been long acquainted with certain forms of fossil animalcules, which for the most part have been inhabitants of fresh water and of recent deposit; but it is from Ehrenberg, the greatest authority in these matters, that we first obtained information of the existence of the skeletons of creatures of this class, in strata belonging to the lower tertiary and upper secondary formations, which have been found in the chalk marl, and chalk itself, of this and other countries.

Recently an enormous deposit of a sandy character, more than twenty miles in length and often thirty feet in thickness, has been detected by Prof. Rogers, occurring between the Eocene and Miocene periods of the tertiary formations, at Richmond and Petersburgh in Virginia, which is composed for the most part of the siliceous skeletons of animalcules which inhabited the ocean at that period of the world's history; and the indistructible character of their skeletons, permitting their accumulation for ages, the bed of the ocean has been made dry land from the death of the myriads of such creatures that once occupied the water as their living element.

Through the kindness of Prof. Bailey of West Point, New York, who is now so well known for his zeal in microscopical pursuits, and his admirable essay on the American Bacillariæ in the Transactions of the Association of American Geologists, 1841-2, this country has been supplied with abundance of the deposit from the above localities.

In examining the sand from these two districts, the Petersburgh will be found to be the richer in the varieties of animalcules, and to contain several species which the other does not, and which in fact have not been at present detected in any other situation in the fossil state.

Prof. Bailey, who has minutely examined the sand from Petersburgh, has, in a letter to me, sketched certain forms, which are different from any hitherto described as existing in any other locality; and mentions, that it is certainly the richest yet found in the number of species contained in a given quantity.

The most common forms met with are specimens of *Gaillonella sulcata*, *Coscinodiscus minor*, *radiatus*, *Patina* and *Oculus Iridis*,* *Actinocyclus biternarius*, *octonarius*, *denarius*, *bisenarius*, and some other species, most of which have been figured by Ehrenberg. With regard to the other species, Prof. Bailey observes, "you will find, without difficulty, numerous specimens of a species of *Zygoceros*, closely allied to *Z. rhombus* of Ehrenberg. Its surface is covered with fine striæ and spots. It probably formed zig-zag chains, like the recent species of Boston Harbour, which I discovered last year, and named *Emersonia elegans*, supposing it to be new. A second very remarkable form, which I believe is also a species of *Zygoceros*, probably entirely new (fig. 3, plate IX), which I propose to call *Zygoceros Tuomeyi*, after the discoverer of the locality."

"One or two species of *Triceratium*† are abundant with the above; but perhaps the most beautiful form is what I believe to be a large species of *Tripodiscus* (fig. 1), fragments of which are abundant, and occasionally entire discs may be found, showing, however *six* feet, sometimes three, four, five or seven, instead of three. Three of these, however, are only seen distinctly at once, the other three then looking like openings. I propose to call this *Tripodiscus Rogersi*, from Prof. Rogers, who discovered the infusorial stratum of Virginia. The feet are placed, as in fig. 1, upon an elevated circle; all the space within the circle is slightly concave, while outside of it the shell slopes abruptly to the outer ring, which is exhibited in section in fig. 2. The whole surface is elaborately marked with cells, something as in *Coscinodiscus*, but still more complex. I am not aware that either *Zygoceros* or *Tripodiscus* were detected by Ehrenberg in the fossil state."

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* Prof. Bailey observes, that several species of *Actinocyclus* and *Coscinodiscus* inhabit the Hudson at West Point, and that he has had daily opportunities of examining them in a living state, and probably was the first person to find these creatures, having seen them several years since, but then imagined them to be the cornea of some Crustaceans or insects, and let them pass without further notice.

† One of the species of *Triceratium* appears to be identical with *T. striolatum* of Ehrenberg.

"Besides the foregoing I have noticed a most remarkable form, of which fig. 4 will give a good idea. It appears like a portion of a *Triceratium*, having four long spines from its disc: the surface is marked much as in many species of *Actinocyclus*. If it proves new, it may be called with propriety *Triceratium spinosum*. I have found but one fragment as yet."

Besides the species mentioned, Prof. Bailey has forwarded skeletons of a most singular form of animalcule, of which figs. 9 and 10 represent a front and side view. Nothing analogous appears to be described by Ehrenberg in his Memoirs in the Transactions of the Royal Academy of Berlin, 1840, and most probably it is the type of a new genus belonging to the family *Bacillariæ*, and may not be improperly named *Ocularia Baileyi*.*

Species of *Dictyocha*, *D. fibula* and *speculum*, together with numerous *Naviculæ*, and fragments of other animalcules, whose form is scarcely to be restored by the imagination, exist together with the above, in the minute quantity of the earth that is required for one microscopic object; probably the thousandth part of a grain may contain at least twenty species of these minute yet wonderful creatures.

The diligence with which Prof. Bailey has examined this earth, leaves but little hope for the future discovery of many other species; still there is the opportunity offered for making some remarks on certain species, and also on the methods of reproduction of the siliceous coated animalcules.

The genus *Tripodiscus* is unquestionably one among the most elegant of either the recent or fossil animalcules; the perfectly circular form of the valves, and the elaborate markings upon each, conspire to make it one of great beauty and interest. The markings are seen to be of two kinds, viz.:—a series of minute circles and multitudes of dots, which appear to be arranged in lines radiating from the centre; these two cannot be distinctly seen with a high power with the same focus, therefore it is probable that the two kinds of markings are not on the same surface of the valve, but one on each. The fossil specimen is very unlike that figured by Ehrenberg as *T. germanica*, and is rightly considered so by Prof. Bailey, who has given it a different name. Ehrenberg's figure is taken from a recent species, he not having discovered it in the fossil state.*

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* This genus is to be recognised by the following characters:—

OCULARIA, *Char. gen.*—Animal polygastricum, è Bacillariorum familiâ, liberum, loricâ bivalvi, obliquè ellipticâ (siliceâ) in utroque latere tribusrvel quatuor circulis concentricis notatâ, interno extantiore.—*E. J. Q.*

With regard to the genus *Dictyocha*, it appears to me to be the most anomalous form of skeleton that any animal could possess; and I have long thought, since the discovery of the varied and elegant spicula of sponges by Mr. Bowerbank, that these supposed animalcules of Ehrenberg were nothing more or less than bodies of that nature. This is not altogether conjecture; because one genus at least, of the same character, *Amphidiscus rotula*, has been shown to be but the spiculum of a certain sponge; and it is not unlikely, I presume, that the genus *Dictyocha* may ultimately be found to be composed of like bodies, because the figures of Ehrenberg, as well as the bodies themselves, indicate that the bars of the skeleton have a trace of canal within, which is characteristic of the structure of these organs.

It must have struck many observers, that the most part of the siliceous coated animalcules appear destitute of organs of reproduction, or of apertures through which ova may be emitted; and also that the same manner of self-division, as practised with the soft-coated creatures, could not be effected with so unyielding a material as silica. Still it is to be observed that these creatures, with the brittle shells, procreate probably with as great frequency as other species, and quite in as simple a method.

It is to be observed in most of this division of animalcules, that what appears to be one perfect being, is divided either by a line or band into two symmetrical portions, which portions appear to be not halves of one animal, but two creatures united by one medium. This band or line between the two is apparently more friable than any other portion of the skeleton, and we constantly see the halves separated through this medium, and each possessing a perfect entirety. There can be no doubt that each half has the power of causing to grow from itself, on that side next the band, a portion which becomes ultimately like itself, and the newly formed portions, also, acquire a band on each just as the parent does; consequently the originally twin creature becomes two twins, and occupies double the length of the original, which double length is obtained by the old band elongating to such an extent, until it breaks, when the new creatures become separate individuals, in their turn, to go through the same set of actions. This is clearly to be seen in *Isthmia obliqua* (fig. 11), and there is no doubt that it is the same process by which the other forms of creatures of the same family are perpetuated. In *Diatoma* and *Fragillaria* there is no band connecting two symmetrical halves, but the frustules are applied to each other in a continuous line, not each one becoming distinct; consequently the self-reproduction is only effected by each terminal cell building on another to itself by its peculiar vital endowments.

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* Besides the large discs of *Tripodiscus* and *Coscinodiscus*, there are to be found some others quite as large as either of the above, but with a very different arrangement of the markings on the valve, being neither dots nor circles, but a pattern formed of continuous lines, having irregular reticulations.—[Ed.]

It is a remarkable fact, that Ehrenberg detected in the chalk and chalk marls from Oran in Africa, Caltanisetta in Sicily, and certain parts of Greece, no less than *fifty-seven* species, which are identical with existing animalcules at Cuxhaven and other localities in the North Sea, making good the opinion entertained by geologists, that in the higher classes of fossil organic remains no representative exists on the earth, but in the lower the identity of many species is perfectly established.

By the aid of the microscope we have been enabled to discover the universality of these creatures, for the same are met with in the polar as are found in the tropical seas, and those of both regions can be proved to have existed at the earliest dawn of this world's existence; which is a striking proof of the important part which these minute organisms were created to perform in the deposition of materials for the earth's surface, and how, by these imperceptible agents, such gigantic consequences have resulted; which stamp upon reflecting minds, that no creature, even the most minute, is formed without special purposes; and that the least in size of all, by the organization given to them by the great Architect of the universe, have been employed to carry out his unfathomable intentions.

Explanation of Plate 9.

Fig. 1. Portion of *Tripodiscus Rogersi*. Bailey.
Fig. 2. The same represented in section.
Fig. 3. *Zygoceros Tuomeyi*. Bailey.
Fig. 4. *Triceratium spinosum*. Bailey.
Fig. 5. Oblique view of a species of *Zygoceros*.
Fig. 6. Side view of another.
Fig. 7. End view of another.
Fig. 8. Side view of another.
Figs. 9 and 10. Front and end view of *Ocularia Baileyi*.
Fig. 11, *a, b, c, d, e*. Diagrams of different conditions of *Isthmia obliqua* during the process of reproduction.

Reviews and Analyses.

The Physiology of Inflammation and the Healing Process.—By BENJAMIN TRAVERS, F.R.S., &c.—S. Highley, Fleet Street, pp. 226.

THE author of the work, of which the above is the title, has long been favourably known to the medical profession by his writings. His "Inquiry concerning Constitutional Irritation," is quite sufficient of itself to stamp him as a philosophical observer of great merit; and besides this, the "Surgical Essays," which he published in conjunction with the late Sir Astley Cooper, and his "Synopsis of the Diseases of the Eye," have been favourably received by the profession. It was not, therefore, without some degree of interest, and hope of reaping some profit, that we commenced the perusal of this his latest work, and we can conscientiously state, that our anticipations have not been altogether disappointed.

Mr. Travers commences the work, as most authors do, with an "Introduction," in which he alludes to the prevalence, even in the present day, of the doctrines of John Hunter, and to the confirmation of the general principles of inflammation as laid down by that great man; but it was not without some surprise that we found him making such an error as the following, especially while, in doing so, he is alluding to Mr. Hunter's experiment showing the difference between the living and the dead artery. For instance Mr. Travers states, as the opinion of Mr.

Hunter we presume, "in the larger arteries the muscular, and in the smaller ones the *contractile* property, is said to predominate; but whether any order of vessels possesses more than the elasticity which accurately preserves the vessel under its varying dimensions in a state of fulness, is an open question." Now we do not know any work, antient or modern, in which the first part of this sentence is to be found, although many physiologists of eminence think it doubtful if the arteries possess any muscular coat, and therefore any vital contractility. But whatever opinion may be entertained upon the muscularity of arteries the *contractile property* should surely go with the muscular structure; that is, if the commonly received opinions upon what structure contractility is due, are entitled to any weight. It is not improbable that Mr. Travers may have confounded, in this instance, contractility with elasticity; but even if this be the case, he is at variance with the opinions of Mr. Hunter, as the following extract from the work of the latter renders evident:—

> "From the account we have given of the substances which compose an artery, we may perceive it has two powers, the one elastic, and the other muscular. We see also that the *larger arteries are principally endowed with the elastic power, and the smaller with the muscular; that the elastic is always gradually diminishing in the smaller, and the muscular increasing, till at last, probably, the action of an artery is almost wholly muscular;* yet I think it is not to be supposed but that some degree of elasticity is continued to the extremity of an artery.
>
> "The muscular power of an artery acts chiefly in a transverse direction;......the elastic power (power of re-action, *not contractility*) is best fitted for sustaining a force applied to it (*such as the motion of the blood given* by the heart), and propelling it along the vessel; the muscular power, most probably, is required to assist in continuing that motion, the force of the heart being partly spent."

It was Mr. Hunter's opinion, that elasticity was the most fitting property with which the larger arteries could be endowed, since elasticity is the best adapted "for taking off the immediate force of the heart;" and he carefully distinguished the elastic from the contractile, or, as he styles it, the muscular powers of arteries. This opinion of Mr. Hunter regarding the structure of arteries has been confirmed, in every particular, by the first living authority on general anatomy, viz., Henle, the celebrated professor of General Anatomy and Physiology in the University of Zurich, and is one in which we are disposed to concur, notwithstanding that the celebrated Swedish Chemist, Berzelius, could not detect, by chemical analysis, any trace of fibrine (the basis of muscular tissue) in the coats of arteries.

Passing over the "Preliminaries" we proceed at once to the "direct effects of stimuli and of wound." See the author's description of them, as witnessed after the application of salt and ammonia, and the infliction of a wound.

"The first effect of a drop of stimulant fluid, or of a wound upon a transparent web (frog's foot), as seen in the field of a powerful microscope, is to arrest the circulation at the part. Around the point of absolute stagnation the column of blood oscillates, and the particles are seen to separate and congregate in small irregular masses, presenting varieties of shape, some being perfect ellipses, others spherical. The vessels are dilated, and in proportion their fulness is increased, and their pink colour heightened. Still more remote from the stagnant centre, increased activity of circulation prevails. The point of stagnation—the very slow circulation in the part immmediately surrounding it, the current still oscillating in parts—and beyond this the more rapid and vigorous circulations are manifested for several days."

The above description corresponds closely with the description of the congestive stage of inflammation by M. Dubois, of Amiens, of which we give the following translation:—

"*Period of Congestion.*—The slackening of the blood becomes more and more manifest; we observe then a remission more or less marked, in the place of an uniform and continuous projection. There are some jerking propulsions, but not as yet any arrest; the sanguineous column still advances without any interruption; then we remark, after each propulsion, a time of arrest, of repose; soon we perceive, that after each propulsion there is a distinct movement of recoil, which alternates with each movement of progression; and then takes place the ultimate oscillations. By degrees the extent of the oscillations diminishes, whilst the periods of repose increase, until at last they become imperceptible and cease altogether; there is then, for the last term, a complete suspension and absolute cessation of all movement in this part of the capillary system. In proportion to the slackening of the circulation, so the globules approach one another, and become heaped together. In the principal arterial capillaries, in proportion to the incumbering of the vessels, all space between the column of globules and the walls of the capillaries disappears; the globules become irregularly heaped together; they come in contact with the walls, and more, they press them laterally, deform, and distend them to double or triple their normal diameter.

"*Period of Resolution.*—After a variable time, some slight movements begin to manifest themselves. At first we observe some feeble oscillations—the extent of them, at first barely perceptible, becomes greater and greater, and the periods of repose, the intervals, smaller and smaller, until they cease altogether. We then observe propulsions *without the movement of recoil,* then some that are simply remitted, that is to say, a veritable pulsation, and ultimately a continuous movement."

Now to what is the stagnation of the blood in the vessels owing? Upon this Mr. Travers states nothing. Mr. Wharton Jones, in his Report,* appears to entertain the opinion, that the congestion which succeeds to the temporary acceleration of the capillary circulation in an inflamed part, is due to the red blood corpuscles adhering together in rolls (like rolls of coins), and to the walls of the vessels till stagnation occurs, and that the stoppage of the circulation in the capillaries when certain salts are added to the blood, and that which takes place in asphyxia, depend on a similar adhesion of the corpuscles. We are disposed to think, that the stagnation is not the result merely of this adhesion of the red particles one to another, and to the walls; because, although we sometimes see this arrangement of the discs in the vessels in which stagnation has occurred, it sometimes occurs, however, and not unfrequently, that the particles are seen to be even separated from each other, and not adhering; and this almost uniformly appears at the first stagnant point. We are inclined to attribute it *partly* to this, but *principally* to the partial coagulation of the liquor sanguinis in the vessels, the coats of which are most probably deprived, by the application of the stimuli, of their proper nervous influence. On the withdrawal of this nervous influence, which is very likely to be an effect of the application of stimuli, or, after a wound, to the exposure of the incised parts to air or water, the condition of the blood contained in the surrounding vessels may be considered to resemble blood when drawn out of the vessels, and, like it, coagulates, again to become fluid by some vital act on the restoration of the nervous influence when the process of resolution takes place. The particles most probably act a passive part in this stagnation; for, if we observe the oscillations attentively, they appear to resemble, in every respect, the movements of inert matters in a jelly when shaken, or when small particles are placed in a glass tube containing coagulated gelatine, and periodical impulsions are made at the end of the tube—both ends being previously secured by membrane.

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* Brit. and For. Review, Oct. 1842.

To return to the work: the author, after describing minutely the direct effects of stimuli and of wound, goes on to speak of the local and constitutional symptoms, which are clearly and concisely stated, and then of the processes of affusion and adhesion. The following is the author's description of the adhesive process after the infliction of a wound:—

"In a wound with loss of substance, which offers the most complete example of organization, the fibrine is very gradually deposited, little by little, at its margin, preserving at all points an uniform line of approximation to the centre. The margin is elevated, rounded, and opaque at its base; its salient edge is thin, sharp, and transparent.

"This presents no appearance of vascularity during the process, but the circumjacent vessels are observed to multiply and extend their branches of communication or anastomosis. These processes go *pari passu* towards the healing of the breach; the fibrine becoming fuller, and more opaque where it adjoins the original texture, and in the same proportion encroaching upon the void space. The wound preserving its figure, continues to diminish as the surrounding parts become organized by the production of transparent capillaries from the nearest vessels, in forks and arches of communication one with another, parallel for the most part to the margin of the wound. These vessels are visible in fine striæ before circulation can be detected. A single globule is first observed to enter, and this is followed by more, which have only an oscillatory motion for many hours, a flux and reflux derived from the impulse of the circulation in the parent capillaries; which see-saw movement continues gradually gaining in the direction of the nearest neighbouring vessel, into which at length the pioneer globules enter in single file. The next stage is the abrupt and rapid occasional transit of a globule, or of several isolated globules in succession, through the new channels, just as drops of rain course one another down a window pane in the same track.

"The conclusion of the process is a regular uninterrupted transition of a file of globules, by which a cross branch of communication is established. This is the simplest example, but the complications of anastomosis proceed in a similar manner. Instead of the meeting of parent vessels, one new vessel encounters another, and they join and divaricate at an angle so acute as to be refluent upon itself to the vessel from which it emanated, or to contiguous ramusculi from the same parent, and thus arches and circles forming a mesh of anastomosis are established.

"The nascent blood vessels appear in the first instance destitute of colour, by reason of the paucity of the blood globules which they convey. .....The appearances of vessels striking directly across the newly deposited lymph to meet their opposites—of vessels seemingly engrooved in the lymph by a train of blood globules pioneering their track—of muscular specks and zones in the fibrinous deposit, which generate and throw off pencils of vessels for anastomosis with each other and with those proceeding from the margin, are doubtless presented at different stages of the process.......The whole business of organization and encroachment is of and from the margin of the wound, and it is upon the margin and its gradually developed organization and encroachment, that the healing action is first and last seen, *i. e.* until its obliteration by the cicatrix. There is no such thing as isolated or independent vascularization, although appearances sometimes exist that convey this impression."

The remaining portion of the work is occupied by details of the periodical phenomena of wounds during the healing process, as witnessed in frogs, in which observations Mr. Travers was assisted by Mr. John Quekett, which is alone sufficient to command for this portion of the book an attentive perusal. The author then enters into the consideration of the various forms of inflammation, viz., the suppurative, ulcerative,, and gangrenous, and of the methods in which the healing process is effected in each.

We could have wished to have made some remarks on these portions of the work, especially on that relating to the suppurative process; but we feel that we have already taken up too much of the space of this Journal, and shall therefore content ourselves by stating, that on the whole the work is an useful acquisition to medical science, and will be found especially useful to students; because in it they will find all the subjects connected with the inflammatory processes simply and concisely stated. It will not be without interest also to the advanced physiologist.

[While the above was passing through the press, we find in the Edin. Med. & Surg. Journ. for 1844, that Dr. Bennett attributes the stagnation of the blood in inflammation to an increased attraction between the blood and surrounding parenchyma." This explanation of Dr. Bennett and his reasons for it in nowise alter the opinion above expressed by us upon this point.]

Anatomical Manipulation; or, the Method of Pursuing Practical Investigations in Comparative Anatomy and Physiology, with an Introduction to the Use of the Microscope.—By Alfred Tulk, M.R.C.S., &c., and Arthur Henfrey, A.L.S., &c.—J. Van Voorst, Paternoster Row, pp. 432.

This work fills up an hiatus which has been too long allowed to exist in this department of science. We feel convinced from an attentive inspection of its contents, that had such a work been in existence some years ago, our anatomical studies would have been much facilitated; and the want of a book in which we could find recorded the various modes which the experience of others pointed out as the best, was severely felt by us.

Although Pole's book, the last edition of which was published in 1813, contains a great deal of useful information on the different kinds of injections, the modes of corroding and preparing anatomical structures, &c., yet, as is justly remarked by the authors, "the science of minute anatomy, aided by the recent improvements which have been made in the construction of the microscope as an instrument of research, is the creation of the present day; and the work referred to (Pole's), though well adapted to the time at which it appeared, is now, in many respects, useless to the inquirer in the wide and interesting field of comparative and structural anatomy."

This work contains, in a condensed form, the whole of the *Traité Pratique et Theorique d'Anatomie Comparative* of Straus-Durckheim (Paris, 1842); in addition to which, some valuable information relating to the use of the microscope is given in the second, as well as in other parts.

It is altogether impossible to give an analysis of such a work as this, abounding as it does in information so varied; suffice it to say, that it contains all the information, previously scattered in numerous works, upon the mechanical arrangements necessary for dissecting and preparing animals or parts of them; receipts for all the injections at present in use, and method of using them, as well as the methods best adapted for dissecting and preserving the various systems of organs in the vertebrated and invertebrated classes of animals.

In conclusion we feel bound to state, that a more useful contribution to anatomical science has not been issued from the press for a long period, and we cordially recommend it to those of our readers who are now commencing their anatomical investigations, and as a work of reference to more experienced anatomists. Numerous illustrative diagrams are interspersed throughout the work.

Abstracts from Journals, and Proceedings of Microscopical and other Scientific Societies.

Researches upon some Animalcula developed in great number in the Stomach and Intestines, during Digestion in Herbivorous and Carnivorous Animals. By M. M. Gruby and Delafond.—In 1685 Leeuwenhoeck first discovered three species of microscopic animalcules in the excrements of frogs.[*] Bory de Saint Vincent, Müller, Ehrenberg, have also detected the presence of animalcules in the excrements of salamanders.[†] Leeuwenhoeck states also that he saw three species of the Infusoria in the excrements of pigeons, fowls, and even in man; but this last discovery has been considered doubtful by other observers, particularly by Ehrenberg. The above observers communicated, in a note to the Academie des Sciences, the fact that they had discovered several distinct species of animalcules in the stomach and intestines in herbivorous and carnivorous animals during the digestive process.

1st. Ruminants have, during the digestive process, in the cud and the chyme, four species.

First Species.—Form, long and flat, body provided with a granular carapace, convex above, flattened beneath, and indented towards its posterior part; head distinct; a band of vibratile cilia around the middle of the body, a long conical and moveable tail; movements of the cilia are rapid, those of the body slow; length nearly $\frac{1}{4}$ of a millim. ($\frac{1}{104}$th of an English inch); diameter, $\frac{1}{8}$ of a millim. ($\frac{1}{208}$th of an English inch). This animalcule bears no analogy to those already known.

Second Species.—Ovoid form; body covered by a carapace indented before and behind; a conical tail; a crown of vibratile cilia at the anterior part of the body; movements very distinct; length, $\frac{1}{20}$ of a millim. ($\frac{1}{520}$th of an English inch); diameter, $\frac{1}{30}$ of a millim. ($\frac{1}{780}$th of an English inch). This species is analogous to the *Brachionus Polyacanthus* of Ehrenberg.[‡]

Third Species.—Form lengthened and cylindrical; a smooth carapace; no tail; vibratile cilia around the mouth; movements very rapid; length, $\frac{1}{780}$th of an English inch; diameter, $\frac{1}{1300}$th.

This species has a close resemblance to the *Enchelis nebulosus* of Ehrenberg.

Fourth Species.—Form oval; no carapace; cilia upon all the surface of the body; buccal opening at one of its extremities; movements rotatory, and very rapid; length, $\frac{1}{112}$th of an English inch; diameter, $\frac{1}{520}$th. This species bears a great analogy to the *Leucophris anodontæ* of Ehrenberg, which Müller has seen in the water of the sea-mussel.

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[*] Anat. et Contempl. 1685, p. 38.

[†] Die Infusionsthierchen.

[‡] Loco citato.

The carapace, or transparent envelope of these animalcules, permits the observation in their interior of the alimentary molecules with which they are nourished, and which render their bodies more or less opaque.

The number of these animalcules is so considerable, that in a little less than a grain of alimentary matters taken in the first two stomachs of the sheep, for example, there existed from fifteen to twenty of different kinds and sizes.

Considering that all these animalcules are principally composed of fibrine and albumen, we may estimate that the weight of from fifteen to twenty of these little animals existing in each grain, or nearly a grain (five centigrammes) of the stomachal liquid, constitutes nearly the fifth part of the total weight of the liquid in which they live.

Now sheep have an average of 3 to 5 kilogrammes (about 6½ lbs. avoirdupoise to 11 lbs.) of aliments in the first and second stomachs after an ordinary repast; the total weight of animalcules contained in these two stomachs will thus be the fifth part, or from 600 to 1000 grammes (19 to 32¼ ounces).

In the third, and particularly in the fourth stomach, these animals are dead, and we can recognise them only by the form of their carapace, which is then quite transparent. We could perceive no trace of those animalcules which have no carapace.

In the small and large intestines we only found some remains of the carapaces.

2nd. The horse has, in the cœcum, and dilated portion of the colon, seven species of animalcules.

First Species.—Form, elongated, and conical at its anterior part; head not very distinct; posterior part of the body terminates abruptly: no tail; a granular carapace; two short anterior extremities, which are articulated and mobile, and terminated by some floating filaments; movements slow, and analogous to those of the tortoise; length, $\frac{1}{208}$th of an English inch; diameter, $\frac{1}{416}$th.

Second Species.—Form, elongated, and a little flattened; head distinct; carapace granulated; body provided with four extremities articulated upon the lateral parts, of which two are anterior and two posterior, all bearing pencils of floating filaments; a crown of vibratile cilia at the posterior part of the body; movements slow; length, $\frac{1}{416}$th of an English inch; diameter, $\frac{1}{780}$th.

Third Species.—Form, ovoid; granular carapace; a tuft of cilia at the anterior posterior, and on the right and left of the body; movements slow; length, $\frac{1}{780}$th of an English inch; diameter, $\frac{1}{1040}$th.

Fourth Species.—Body elongated, ovoidal; anterior and posterior parts of the body furnished with cilia; movements slow; length, $\frac{1}{1300}$th of an English inch; diameter, $\frac{1}{1556}$th.

Fifth Species.—Form, spheroidal; cilia upon the whole surface of the body; lively and rotatory movements; diameter, $\frac{1}{492}$th of an English inch.

Sixth Species.—This animalcule has some resemblance to the form of the turtle; carapace flattened, and bearing three slopes, two of which are furnished with tufts formed by large cilia; diameter, $\frac{1}{390}$th of an English inch.

Seventh Species.—Monad; $\frac{1}{2600}$th of an English inch; the alimentary matters, more or less hard and moulded, contained in the last portion of the colon, and in the rectum, offered only the carapaces of all these animalcules.

3rd. The dog has in the stomach two species of Monads.

First Species.—Body pyriform, terminated by a little tail; superior surface of the body convex, inferior face flattened; movements very lively; length, $\frac{1}{1300}$th of an English inch; diameter, $\frac{1}{2600}$th.

Second Species.—Body filiform; movements executed forwards and backwards with slowness; $\frac{1}{3200}$th of an English inch long.

The duodenum, and the anterior third of the middle portion of the small intestine, contain these Monads. The last third, the jejunum, cœcum, colon, and rectum, did not offer any.

4th. The hog had only one species of animalcule in its stomach.

Form, oval, flattened; posterior part terminated by a conical tail; borders thin, and furnished with cilia; movements very lively; length, $\frac{1}{1300}$th of an English inch; diameter, $\frac{1}{2600}$th.

This animalcule bears a considerable resemblance to the *Monadina* of Ehrenberg.

The small intestines contained none.

5th. The animalcules of digestion are generated, live, and swim in the acid liquid contained in the stomach. By placing the stomachal matters in glass tubes kept constantly at a temperature of 86° to 95° Fah., they may be preserved alive for two or three hours, or even longer.

6th. The great number of these animacules in the first two stomachs of Ruminants, the presence of their carapaces seen in the third, in the fourth, and in the excrementitial matters, the number equally considerable in the cœcum and colon of the horse, as also the existence of the carapaces in the transverse colon and rectum, induce the conclusion that the organic matter of these animalcules is digested by the rennet of the Ruminants, that it is absorbed in the colon of the horse, and that, in the one as in the other viscus, it gives an animal matter for digestion.

7th. The consequence of this fact is, that herbivorous animals, as the sheep and the horse, take into their stomachs, in their natural state, vegetable matters, the fifth part of which is destined to give birth to, and to keep alive, a large number of animals of an inferior development, which, digested in their turn, furnish *animal matters* to the general nutrition of these herbivorous quadrupeds. In the dog and pig, which derive their nourishment from animal and vegetable substances, the animals are small, of one or two species only, and are seen in very small numbers.—*Comptes Rendus.*

Germination of the Reproductive Bodies of certain Algæ. By Dr. G. Dickie.—Some time ago a few experiments were made for the purpose of ascertaining the mode of germination in *Fucus canaliculatus*. A considerable quantity of its seeds were placed on slips of glass, to which they readily adhered. These were kept immersed in sea water, which was renewed every four or five days. The experiments were conducted in a room of moderate temperature, and in the month of December. In about three weeks the seeds were found to have undergone a change of form—from triangular, with rounded angles, they had become spherical. In the next stage, a slight swelling was observed on many of them; and, at a more advanced period, there issued at this place several minute transparent filaments, never exceeding four in number from the same seed; one or more of these had usually made greater progress than the others. In their interior was seen a granular matter of a pale yellow colour. The observations were interrupted at a more advanced stage, when the filaments appeared to have become coherent at their bases. By careful examination under the microscope, it was found that each seed consists of two coats—the inner the most delicate of the two, and containing a granular matter; the filaments appeared to be prolongations of it, and to have burst the outer and stronger membrane.—*Annals of Natural History, January,* 1844.

Mr. Crum on the manner in which Cotton unites with Colouring Matter.—"It appears to me that many of the operations of dyeing depend upon this influence of the surface, or the capillary action described by Saussure. The microscopic examination of the fibres of cotton by Mr. Thomson of Clitheroe, and Mr. Bauer, shows them to consist of transparent glassy tubes, which, when unripe, are cylindrical, and in the mature state, collapsed in the middle, from end to end; giving the appearance of a separate tube on each side of the flattened fibre. As the sides of these tubes permit the passage of water, they also must be porous; but the form, or even the existence of such lateral perforations, cannot be detected by the most powerful microscope.

"In many of the operations of dyeing and calico-printing, the mineral basis of the colour is applied to the cotton in a state of solution, in a volatile acid. This solution is allowed to dry upon the cloth, and in a short time the salt is decomposed, just as it would be in similar circumstances, without the intervention of cotton. During the decomposition of the salt its acid escapes, and the metallic oxide adheres to the fibre so firmly as to resist the action of water applied to it with some violence. In this way does acetate of alumina act, and nearly in the same manner acetate of iron. The action here can only be mechanical on the part of the cotton, and the adherence, as I shall endeavour to show, confined to the interior of the tubes of which wools consist, or of the invisible passages which lead to it. The metallic oxide permeates these tubes in a state of solution, and it is only when its salt is there decomposed, and the oxide precipitated and reduced to an insoluble powder, that it is prevented from returning through the fine filter in which it is then enclosed."—*Proceedings of the Philosophical Society of Glasgow, Session* 1842-43.

Extent of Surface in Woven Fabrics.—The fibre of New Orleans' cotton wool varies most commonly from $\frac{1}{1500}$th to $\frac{1}{2000}$th of an inch in diameter. About forty of these fibres or tubes compose a thread of No. 38 yarn (thirty-eight hanks to the pound). Ordinary printing cloth has, in the bleached state, 493 lineal feet of fibre, or 10·6 square inches of external surface of fibre in a square inch, which weighs nearly one grain. It is easy to compress 210 folds of this cloth into the thickness of one inch. It has then a specific gravity of 0·8; one cubic inch has 94163 lineal feet of tube, and 16·8 feet of external surface; or, if we include the internal surface, there are upwards of thirty square feet of surface of fibre in one cubic inch of compressed calico.—*Crum in Proceedings of Philosophical Society of Glasgow, Session* 1842-43.

Curious Confervoid Animal observed by Dr. Van Oye.—This Conferva was found in the stream of a shallow brook, and being examined with a magnifying-glass and a microscope, presented the curious spectacle of a double transformation. The tubes of the Conferva separated in the water into a considerable number of animalcules, possessed of life and voluntary motion; and they afterwards united again at the expense of these same animalcules, in which all animal life had become extinct.—*Medical Gazette, January* 12, 1844; *translated from the Annales de la Societé Medico-Chirurgicale de Bruges.*

[It is unfortunate that the discoverer of this doubtful creature did not give some specific characters, so as to have enabled others to have followed the observations, which appear too extraordinary to have been overlooked by persons who pay considerable attention to these subjects.—Ed.]

On the Abundance of Crystalline Matter in Plants.—Professor Bailey, remarking on the number of these crystals in plants, stated, that the number contained in a single square inch of the liber (inner bark) of many trees, as the willow, poplar, locust, &c., no thicker than a piece of writing paper, was at least a million; and that, consequently, the amount in the whole tree, including wood, bark, and leaves, must be enormous, and yet nearly all the trees of the forest were thus filled with crystals.

Remarks were then made by Professor B. on the important questions concerning the causes and consequences of this vast production of crystallized oxalate of lime in the vegetable kingdom, and upon the development of heat and electricity which must attend its formation. He suggested as questions worthy of examination, whether oxalate of lime is a fertilizer? Whether the fall of the leaves, shedding of bark, &c., might not be nature's method of distributing this substance as a fertilizing agent? Whether it could be detected in soils unchanged? And what changes does it undergo during the decomposition of vegetable matter?—*Proceedings of the Association of American Geologists*, 1843.

Microscopical Society of London.—At a meeting of the Society, held on the 17th January, 1844, J. S. Bowerbank, Esq., F.R.S., in the chair, the Secretary, Mr. John Quekett, made some observations upon the structure of human bones which had been discovered in a bog about ten feet below the surface. When first taken up they were as black as ebony, but on drying the colour had changed to a dark brown. The specific gravity was exactly twice that of water. The most remarkable circumstance connected with these bones was the fact of the earthy matter not only having penetrated into the Haversian canals, but had made its way from them through the canaliculi into the osseous corpuscles. The specimens exhibited had been boiled in Canada balsam, to render them very transparent, and to show the great contrast between the corpuscles which had been filled with earthy matter and those which were still empty. The same fact had been noticed by Mr. Smee, in the bones of a mummy.

The author stated that he had not been able to succeed in filling the corpuscles with injection.

Mr. Dalrymple alluded to a portion of a skull of a Peruvian, in the Haversian canals of which he had seen not only a single vessel running in the canal, but a number of capillaries on the walls of the canals. Dr. Goodfellow mentioned that he had seen the osseous corpuscles artificially filled by Mr. Tomes.

Mr. Quekett then made another communication on the arrangement of the blood vessels in the lower part of the lung of the chameleon, which were so precisely like those in the air bladder of the eel, that it left no doubt in his mind of the respiratory function of that organ.

Microscopical Intelligence, &c.

The best method of examining the Form, Structure, and Movements of Vibratile Cilia.—Take a very small portion of the gill of the sea-mussel, and with a pair of needles detach a small piece of a single bar of it, or a small portion of two or three bars, and separate them a little distance from each other. Place the portion of the branchia so prepared in an animalcula case, or upon a slip of glass, and immerse it in some of the fluid from the shell of the animal; then cover it lightly with a piece of thin glass or with mica. The portion of gill so prepared will exhibit several rows of cilia which, if the animals from which they have been taken be alive at the time of the removal of this portion of the gill, will be seen in active motion of a fanning or a lashing kind. We may here state for the information of those of our readers who may not have witnessed this phenomenon, that no cause for it, no motor power has ever been perceived. It is perfectly independent of the vascular and muscular systems. Contact with the blood is not necessary to its continuance, since it continues just as active when removed from that fluid. It is independent of muscular motion, since it endures longer than the contractility of muscle after death; also, by preventing the blood from flowing to a limb, the muscles become paralyzed; the ciliary movement, on the contrary, as before stated, is unaffected by this withdrawal of the blood. Shocks of electricity passed through the ciliated parts, and the application to them of prussic acid, opium, strychnia, and belladonna, which all powerfully affect the nervous system, produces none upon the ciliary movement—the only thing necessary for the continuance of this movement being the integrity of the epithelial cells, to which the cilia are invariably attached in man and the higher animals. The best time for observing the character of the motion, and the form and structure of the cilia, is some hours after the bar has been prepared, as above directed, and when the movement has become sluggish.

Cleaning Glasses previous to Mounting Objects.—It is highly essential, before putting any cement or liquid on glass which is intended to bear an object, that it should be perfectly free from "greasiness," and water should flow uniformly over the surface. To effect this, it is usual to have recourse to alcohol, alkaline solutions, or sulphuric acid; but recently the Rev. J. B. Reade has discovered, that infusion of nut-galls (which is a solution of tannic acid) answers the purpose equal to if not better than any of the preceding.

The Method to be adopted for observing the Circulation of the Embryo of a Fowl.—When we succeed in preparing an embryo of from 30 to 40 hours, and in detaching it and extending without injury under water upon a slip of glass, and submitting it to the plate of a simple microscope, we observe at one time the whole vascularities and circulatory circles from the heart, which we see contracting and propelling the blood into the aorta, even to the extremities of the arterial divisions, from which the blood passes into the venous radicles, and from those radicles even to the larger veins by which it returns to the heart. It is only by a low magnifying power that we can observe the whole of this phenomenon at one time; but a magnifying power of about 100 linear is necessary in order to be able to examine the details.

When we wish to examine the embryo at different periods, it is necessary to separate the white, and carefully place the yelk in a small cup; this cup or glass capsule is to be placed in a vessel nearly filled with warm water; and if the germ is developed, we shall recognize the extent and capacity of the *cicatricula*. Then cut the membrane around the *cicatricula* circularly by the aid of a pair of fine scissars, and then detach the *cicatricula* by raising it carefully, and by drawing it delicately by means of a mounted needle; shortly it floats on the water, and after having taken out the little capsule with the yelk to disengage it from a part of the adhering yellow matter which interferes with its transparency, it becomes very easy to receive the floating and membranous *cicatricula* upon a slip of glass surrounded with water (a little cell covered with the thin glass would be better), where may be observed the phenomenon above alluded to.

Microscopic Characters of Milk.—A drop of milk placed upon a piece of crown glass and covered by a slip of thin glass, and observed with a magnifying power of about 300 times linear, presents a multitude of spherical particles differing in size from the $\frac{1}{13000}$th of an inch to $\frac{1}{3120}$th. Leeuwenhoeck observed these particles as the following extracts from one of his letters show, by which it will also be seen, that he considered them not to be identical but different in their nature; "*Vidi multos globulos, similes sextæ parti globuli sanguinei et etiam alios, quorum bini, terni aut quaterni se invicem modo attingebant, fundum versus descendere, et multos variæ magnitudinis globulos in superficie fluitantes, inter quos posteriores adipem sive butyrum esse judicabam.*" It is generally supposed that the caseum and the fatty or butyraceous matter concur to form the milk globules, the larger ones belonging to the butter, the others, or smaller ones, to the proximate principle peculiar to milk, the caseum.

Dr. Hodgkin and Mr. Lister state, that the particles found in milk appear to be perfect and very transparent globules—but far from being uniform, they present the most remarkable varieties, in respect to size; whilst some are more than double, others are not a tenth part of the size of the particles of the blood, to which they bear no resemblance. From their not alluding to the composition of these globules, it would appear that these observers considered them to be identical. M. Raspail regards them as being the one (the smaller we suppose) albuminous, the other oleaginous; M. Donné has proved by means of ether that all the globules found in milk, belong altogether to the fatty principle of milk, and not to caseum or albumen, for by applying ether to the globules when separated from the fluid portion of the milk by filtration, they become entirely dissolved, and by agitating milk with ether, all trace of globules are lost,—now as ether has not the property of dissolving caseum and albumen, M. Donné is probably correct in his opinion.

With respect to the organization of these globules, Raspail* states positively that he has seen them enveloped by a transparent and *albuminous* membrane, which is diaphanous, and not in the slightest degree granular, and that they disappear in alkalies as ammonia, and that the milk then becomes transparent. M. Donné† has never seen this enveloping membrane, nor has he observed the effects of alkalies, as stated by Raspail; on the contrary, by treating milk with concentrated ammonia no alteration of the globules was effected; much more, solutions of caustic potash and soda, only acted slightly from long contact with them. At the end of twenty-four hours the globules were seen in the solutions, and heat was also necessary to effect their destruction: "it is true," adds Donné, "that alkalies saponify fatty matters, only by a prolonged action, and only after they have transformed them into an acid, and this is a further proof if any were wanting, that the globules are not formed of caseum"—but still Donné is inclined to regard these globules as organized bodies, for the following reasons:— 1st. Their regular definite form; 2nd. Their size never exceeding a certain measure; 3rd. Were the globules of milk simple particles of butter more or less divided, how do they not run together as drops of oil do when heated? 4th. They are found intact after the ebullition of the milk; and 5th. The long motion or stirring of the milk in order to make the butter is another proof, in M. Donné's opinion, of their being organized. That albumen or caseum does not enter into their composition, is shown by their not turning yellow on the addition of iodine. Among a great number of experiments which M. Donné performed to assure himself of the true structure, he exposed milk to different temperatures, above 212° Fahr. At about 248° Fahr. no appreciable change was produced either in the colour of the milk, or in the disposition of its elements; above this temperature the liquid begins to acquire a brownish tinge, the caseum to coagulate, then in fine, at 288° Fahr. the milk became quite brown, in consequence of the modification of the sugar, and the caseum formed a clot separated entirely from the yellowish liquid or serum. The globules, however, were not included in the clot, they underwent no appreciable alteration, nor could any appearance of a broken or torn membrane be seen. This is a fact, in our opinion, militating against the idea of their being organized.

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* Chimie organique, 2 Edition, Paris, 1838, t. 3, p. 135.

† Cours de Microscopie, p. 359.

Professor Nasse, of Marberg,* gives the following as the constituents of normal milk;—1st. smooth, homogeneous, transparent oil globules and large oil globules, also the common milk globules; 2nd. cream globules, distinguishable by their facette-like appearance; 3rd. granulated yellow corpuscles; 4th. lamellæ of epithelium; 5th. the more or less turbid medium in which the four preceding kinds of corpuscles are suspended.

Nasse believes the yellow granulated corpuscles to be peculiar to the colostrum, or first-formed milk after the accouchment, and Donné has also seen and described this corpuscle.—See his description of the microscopic appearances of the colostrum; "we find a certain number of true milk globules; but these globules are as yet badly formed, irregular and disproportioned among themselves, some resembling large oleaginous drops, and do not merit the name of globule: it is evidently the butyraceous substance badly elaborated. The globules instead of floating freely and independently with each other, are for the most part adherent together. The colostrum contains, besides, some particles having no relation to the ordinary milk globules; they are from the $\frac{1}{2600}$th of an inch, to 10 or 12 times this diameter; they are not always globular, are of a *yellowish colour and granulated.* Both observers think that they are due to mucus from the milk tubes.

Dr. Rees appears to think that the globules found in milk are not organized, and from frequent examination of milk under many conditions, and from many animals, especially human milk and that from the cow, and from the effects of different re-agents, and more especially from the absence of anything like endosmose, I am inclined to hold the same opinion.—S. J. G.

Branched Spiral Vessels.—The existence of ramifying tubes in the interior of plants, saving those denominated *ducts of the latex*, has been more or less doubted by recent vegetable anatomists, though the antients had some gleam of their presence from their descriptions, but still they did not leave us the information where they were to be found. Vessels which fork do unquestionably exist, and, as far as I am aware, do not occur but in one organ of plants, and in one situation, viz., in that portion of a bulb intermediate between the rootlets and the succulent scales (*stem*). If a portion of this be taken, after being boiled or macerated until the tissues have lost all cohesion, and submitted to the microscope, and the bundles of vessels first removed from the cellular tissue, and then separated from each other by sharp-pointed instruments, several will be found distinctly forked, and others of most singular shapes, which can scarcely be said to be cylindrical. The "long leek," when cooked, is well adapted to show these singular vessels, (Plate IX, fig. 16.)—*E. J. Q.*

[*Errata.*—In page 128, line 16, for "generally, and with," read "generally used with," and at line 3 from bottom, for "Todura" read "Podura."]

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* Müller's Archives, 1840, Heft. 3, p. 258.

STRUCTURE OF SHELLS.

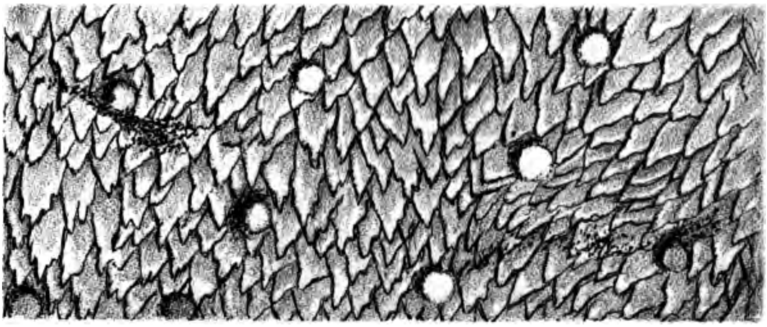


Fig. 6.

Section of Terebratula *(recent.)*

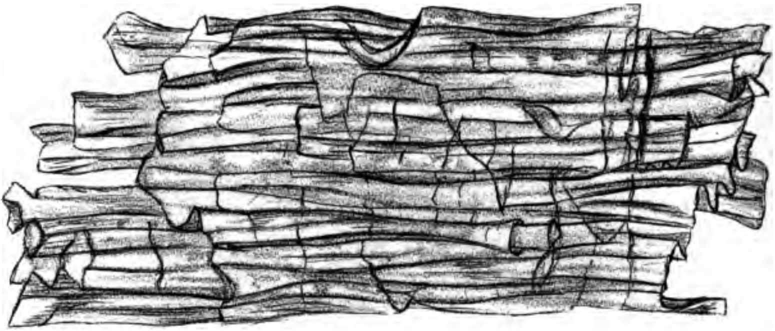


Fig. 7.

Shred of Terebratula (?), *fossil.*

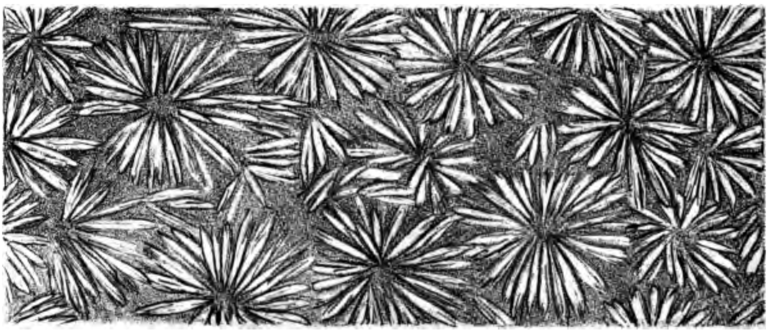


Fig. 8.

Section of Tooth of Mya arenaria.

Sowerby. del. et lith.

prel. lith Linn. imp.
William

Fig.1.

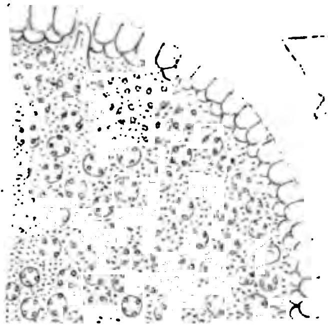
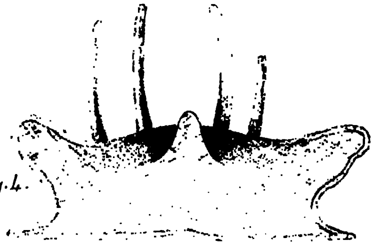


Fig.2.

Fig.4.



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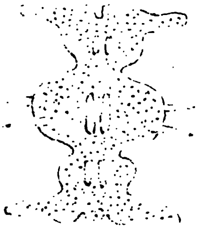

Fig. 5.

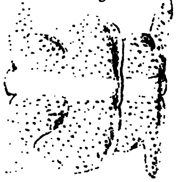

Fig.6.

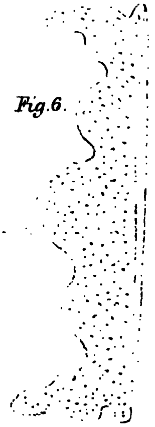

Fig.7.

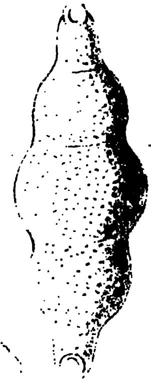

Fig.8

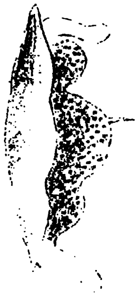

Fig.9.

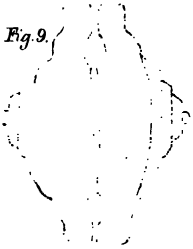

Fig.10.

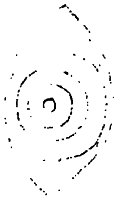

Fig.12.

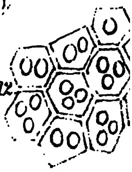

Fig.17.

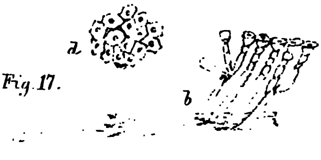

Fig.11.

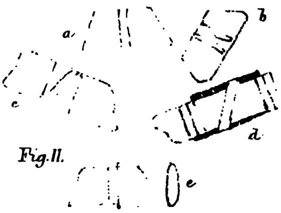

Fig.16.

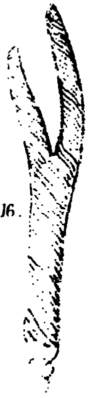

Fig.13.